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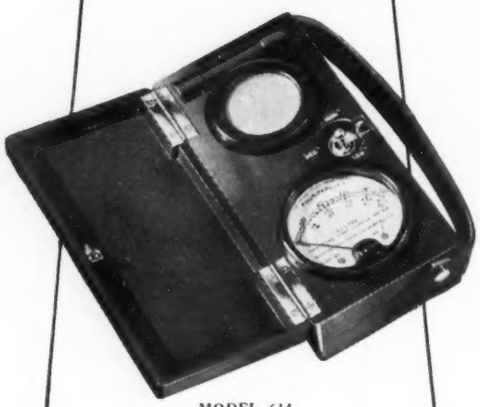

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What in the World!

Sudden enthusiasm develops in California to give away electrical energy. Last week two subsidiaries of Pacific Gas & Electric and Southern Sierras Power announced plans to link intensive promotional campaigns with variations of free energy plans. It will be interesting to observe the results. Perhaps this will be the idea that so pleases the public as to speed the coming of the all-electric home.

•

No sooner had the Pennsylvania Railroad announced its plans for electrification expansion with $77,000,000 of P.W.A. funds than $1,250,000 contracts for generating and incidental equipment necessary to supply the new load were made. Who can foresee the far reaches of purchasing power which $400,000,000 a month of government spending will bring indirectly to all industry?

•

Dr. Luckiesh has been waging a good fight for a far broader and more enlightened approach to the whole problem of seeing than illuminating engineers have been fully prepared for. In this issue he tells what the next steps toward accomplishment of that broader approach must be. Definite and encouraging progress is being made.

•

Strange, but after at least twenty years of satisfactory use of trucks, gasoline and electric, for general-purpose services there still remain fundamental misconceptions of the economic and desirable fields of each. Mr. Rasmussen has done much to clear the atmosphere in his factual discussion this week of a recent analysis.

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February 17, 1934

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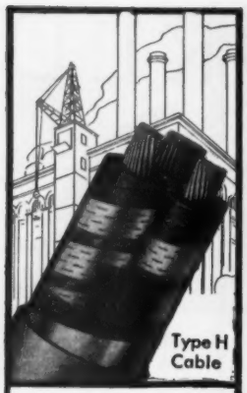
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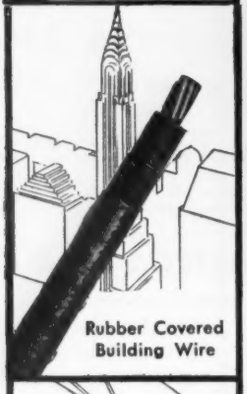
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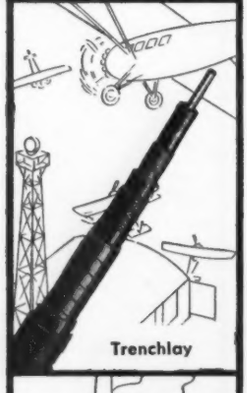
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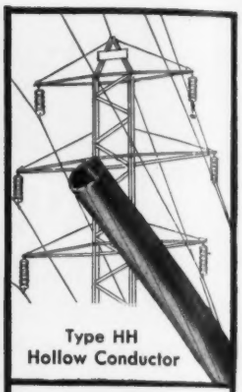
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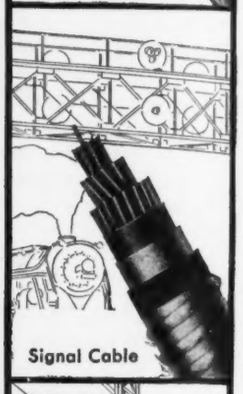
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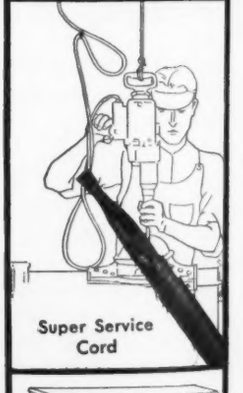
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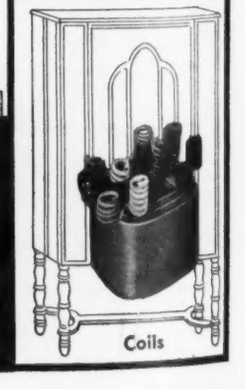
Coils

ELECTRICAL WORLD

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for the Week Ending

February 17, 1934

L. W. W. MORROW, *Editor*

Needed—a Common Program—and Goal

DISPASSIONATE survey of national and local actions with respect to the electrical industry affords amusement as well as concern and proves once again that human beings are irrational. The administration records its conviction that a more abundant and a more universal use of electricity would contribute the greatest of boons to social and economic well being. Then it proceeds to prevent the consummation of this objective by starting subsidized, competing utilities in many localities and by smashing the credit of the established utilities through the use of taxation, investigation and invective. It fails to realize that the present industry is in position to carry out its plans only if it is prosperous. It fails to support the existing industry with financial aid so that it might more quickly and economically market its products and service and expand its facilities.

Local actions in many states are just as inconsistent. There is now a wave of forced rate reductions, appraisals, increased taxation and studies of cost of service to the several classes of customers. These are handicaps and not aids to more abundant and lower-priced service in each state. Any intelligently conducted utility builds for the future and expands its facilities into very thin, and even loss, territory. This has been the practice of good utility managers and is in the public interest for it produces a regional development. Under these conditions, of course, the large cities or the dense load areas bear more than their share of the expense if rates are based upon inventory cost. Also, certain classes of service, such as main-street merchants, pay relatively more than do farmers, residents and industries where utility service is highly competitive. Even in residential service the medium- and large-use customers carry the losses incurred in serving the small-use customers. Utility income and rates are adjusted to fit all these conditions and loss business capable of being built into profitable business is carried in the amount that is made possible by the entire business in a region.

FOR example, the farmers are now demanding electric service. This has been built up slowly by utilities because it is a loss business; nevertheless, a steady and consistent effort has been made to take on as much as possible of rural load and to build up the consumption of rural customers. If this business is approached on a cost-of-service basis it cannot be obtained, yet several states that advocate service to all farms are most insistent upon appraisals and rates based upon cost of service as fundamental to utility rate policies. In addition, these states make appraisals and then increase the assessment value to get more taxes when already from 15 to 22 cents of each dollar of utility income is paid out in taxes.

Inexpensive and abundant electric service in this country will only come when utility managers who know the business are permitted to build and expand and to sell the far-from-saturated markets. They are competent, they have the public interest in mind and they will voluntarily make rate reduc-

tions because they know these are good business if justified. But they must have capital and they must be able to use their income for legitimate purposes and not pay out most of it for taxes, for appraisals and for legal fees necessitated by ever-changing and opinionated orders from legislatures and commissions.

Motor-drive studies will improve service

As the designs of motor drives and controls for different types of machinery progress the importance of making more refined studies of duty cycles is increasingly evident. The tendency is for the electric motor and control manufacturer and the machine builder to realize a better and better mutual understanding of drive problems. A vast amount of experience has been built up in relation to maximum and average power demands of many kinds of machinery during the past two decades, but the selection of motor and control equipment for this class of service is far from a settled issue in the industrial world.

An example of a profitable type of research is afforded by the work of Dr. E. Honegger of Zurich on the cotton loom, published in the *Journal of the (British) Textile Institute* in December, 1933. These studies not only covered the power requirements of a loom when operating under stated conditions and the subdivided wattage demand of certain parts and functions of the machine, but they analyzed the minute variations in speed occurring at different points in the duty cycle, the suitability of gear and belt drives, repetitive reliability of induction motors, inertia and other points. The oscillograph was pressed into service in recording these speed variations and fluctuations in power input in relation to the occurrence of picks, and while the age of the loom tested was somewhat disappointing to American eyes, the methods employed appeared highly significant of a new approach to a vast range of problems in the machine world.

The future purchaser of machinery should become much more interested in this kind of work. He should also approach many problems of motor and control application along the line of improved instrumentation. Duty cycles analyzed in connection with graphic records point the way toward increased precision in the selection and use of materials for both electrical and mechanical equipment. Competition in machine design is more acute than ever under the restricted hours of service enforced upon many industries. Savings in initial cost and improved production are most important. All machine users may not be in a position to resort to laboratory methods of study to the extent illustrated by Dr. Honegger's researches, but they are likely to demand more instrumental information from their own staffs as well as from bidders than has formerly been customary. Skilled judgment is a great asset to the designer, but electrical measurements are likely to become more and more an auxiliary of machine-building progress. One may properly expect the duty-cycle graph to become as common in time in the analysis of motor drives and control as the temperature chart and electrocardiograph record are in the technique of the modern hospital.

Value of service continuity

Not far ahead is the day when expansion of systems to meet new and retrieved loads will be the order of the day. What grade of reliability is going to be built into the new stations and lines? This is something that should be evaluated convincingly now and decided now, not left to hasty determination just before the blueprints are being rushed out.

There are two wholly distinct phases to the problem. One is the value of the service to the customer of every description. The difficult part of this problem is that the viewpoint of the design engineer is quite different from that of the commercial engineer, who sells the service on a competitive basis. The latter deals with the value of the service to the customer when he is getting it continuously without interruption. The design engineer is more to be influenced by the value of the service to the customer when he fails to get it. That involves a far more intricate maze of tangibles and intangibles.

The second phase of the problem is to control the outlay for the system facilities so they will assure the lowest operating cost for rendering the service compatible with the demand of the user that the continuity and quality be such as to make his costs of operation the least. A one-cent kilowatt-hour may prove to be worth as much as two dollars to industry in lost labor and disjointed pro-

duction if it is choked off by a lightning flash or some other electrical disturbance. On the other hand, an equal disparity may exist on the design side. One engineer recently said it might cost only $1,000 more per hundred miles to check a lightning interruption, but well over seventy times as much additional to prevent a sleet interruption. With such spreads in the picture there is urgent need for analyzing the value of the service to see that it jibes with the cost of rendering it.

A time for discrimination

Transition periods like this put increased responsibility on those who pass judgment upon operating data. The old yardsticks of efficient management need recalibration, and unless conditions are understood and properly weighted false interpretations may arise and lead to errors in policy.

It has always been a fascinating task to analyze annual reports of operating companies by reducing gross quantities to unit relationships and percentage ratios. Such procedure is still useful, but it will not do now to measure efficiency largely by dividing mass totals by multitudinous x-units, and for this reason—conditions have changed so rapidly in the past few years that accurate parallels are difficult to draw between widely separated periods of time.

Ten years ago a certain power company's operating ratio was 59 per cent. Now it is 41, but this does not prove that the management has improved 18 per cent. Some engineers have charged that its administration has "gone haywire on economy," while others hold that severe cost cutting has been the acme of prudence. Actually, the company of today and that of ten years ago represent a decided contrast in setups. Coal is far cheaper; plant development has practically stopped; man-power has been reduced in accordance with business requirements (and perhaps beyond necessity); generating facilities are in part idle and possibly overbuilt in relation to present loads; and purchased power has leaped far ahead of a decade ago. Rate reductions, some of them voluntary, have saved customers millions. The picture has changed in almost every line.

Little more need be said except that like must be compared to like if accurate conclusions are to be achieved. This means that the period of comparison must be narrowed to a zone of minimum changes in conditions unless the analyst possesses sufficient detailed knowledge of the property and its administration to give due weight to intangible differences in conditions as well as to evaluate measurable items. Regulating commissions and investors will consider a broader perspective in the future than percentages and unit data alone can supply. The best annual reports exhibit this trend toward interpreting changing conditions and operating results as causes and effects. Mathematical yardsticks are invaluable as economic X-rays, but the art of diagnosing corporate health conditions involves intelligent discrimination. Case histories must be drawn out of the files and analyzed understanding before sound judgment can be passed on the strength of systemic symptoms revealed by short term operations.

Small appliances profitable

In this period of rapid rate reductions and the adoption of inducement rates sight should not be lost of the value of small appliance sales. Range, refrigerator and water heater sales are made to heavy-use customers and bring in low revenue per unit of energy used. Small appliances can be sold to the big majority of small-use customers to bring in revenue at the highest unit rate. It is the small-use customer who is carried at a loss and it is the high-rate revenue that pays the dividends. Thus small appliances sold to a large number of small-use customers is highly desirable appliance business.

This fact should not be forgotten in developing sales programs. An analysis of the market on a selective basis must consider both merchandise and revenue aspects of the business. And utility managements will do well to give extra inducements to small appliance sales if they measure accurately the very desirable effect that these sales will have on revenues. A bonus based upon revenue or some other method of payment will pay because the small-appliance business is the most desirable and the most profitable business to be had. This fact is forgotten in too many instances, as are the ultimate disadvantages of the inducement rate when and if full saturation is had in the domestic market. Now is the time to sell lighting and small appliances with greater pressure than any other devices available for home service.

Paper-Bag-Making Rejects Cut With Photo-Cell Control

By O. C. CORDES

General Engineer
Westinghouse Electric & Manufacturing Company, Philadelphia

Supplanting with accurate and tireless photo-cells the wasteful errors of spoiled production under manual control, paper bag manufacturers find a new fabricating and profit aid.

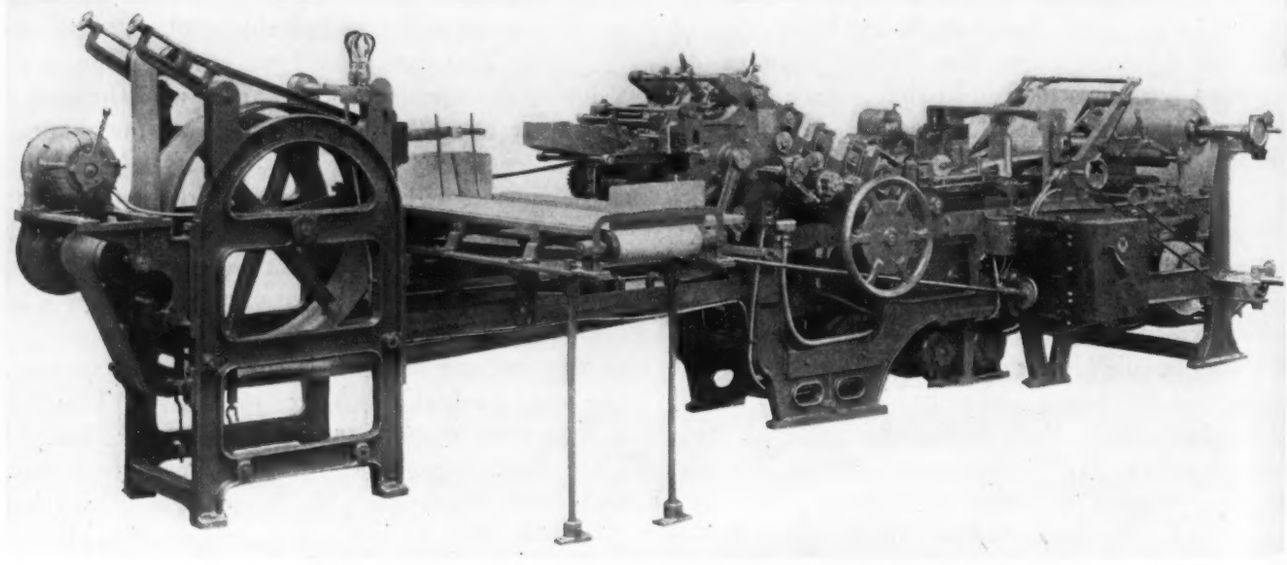
Wherever the cutting and fabricating of continuous rolls of material with a need for accurate register is encountered, similar solutions may be advantageous.

Control of register has been proved readily feasible for speeds as high as 500 units per minute.

MANUFACTURE of bags may be divided into two general classes: (1) Those made from sheets of paper cut to size, and (2) those made from continuous sheets of paper supplied from rolls. Each class may again be subdivided into plain bags and bags carrying printed advertising matter in various color combinations. It is obvious that there is no problem involved to keep the printed matter in the desired location, where the bags are made from individual sheets of printed paper, or where plain bags are made from a continuous sheet of paper. However, where bags are made from a continuous sheet of printed paper the problem of keeping the print in register on the bag is serious, and becomes even more so as the number of bags made per minute increases.

Since the majority of bags are manufactured from a continuous paper sheet on automatic bag machines, this article will be concerned only with the problems involved in this case. The automatic bag machine receives paper from one or more rolls, folds and pastes this into a continuous tube, cuts the tube to proper length, slits, folds and pastes in the bottom. All this is done at the rate of 150 to 350 bags per minute.

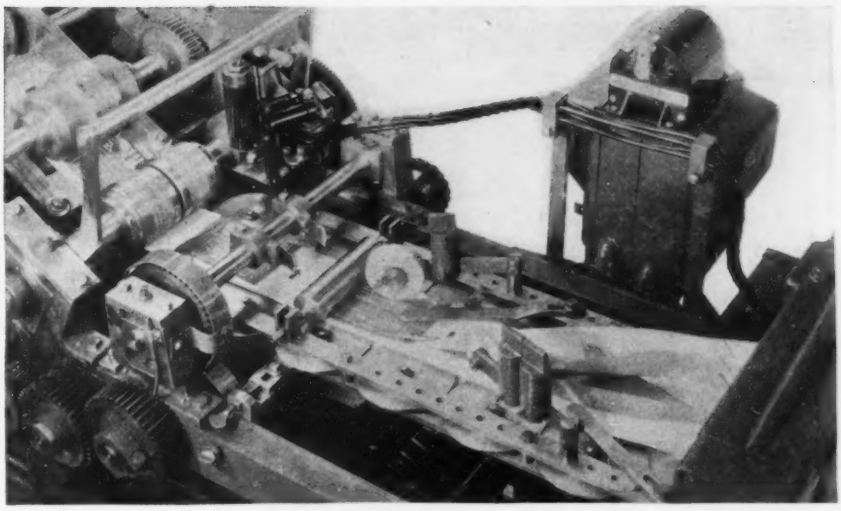
The part of the bag machine of chief interest from the standpoint of register control is that containing the feed rolls and the rotary cutter. The feed rolls are gear driven from the rotary knife through a speed changer and a planetary gear known as the localizer. Normally, these rolls run at a constant speed relative to the cutter speed, as set by the speed changer for the required bag length. Their function is to feed the paper at a constant rate to the cutter, thus attempting to insure that each cut will be made at the same place relative to the printed matter. Due to slippage between the paper and the feed rolls, shrinkage or expansion of the paper, change of tension in the sheet, difference in paper surface smoothness, etc., there actually is considerable variation in the rate of paper feed. Hence it is neces-



Weber automatic bag machine has photo-cell register control
Photo-cell of Westinghouse RR-2 register control is mounted on the shaft of the handwheel X

Scanning head sees the colored spot between prints on the paper strip

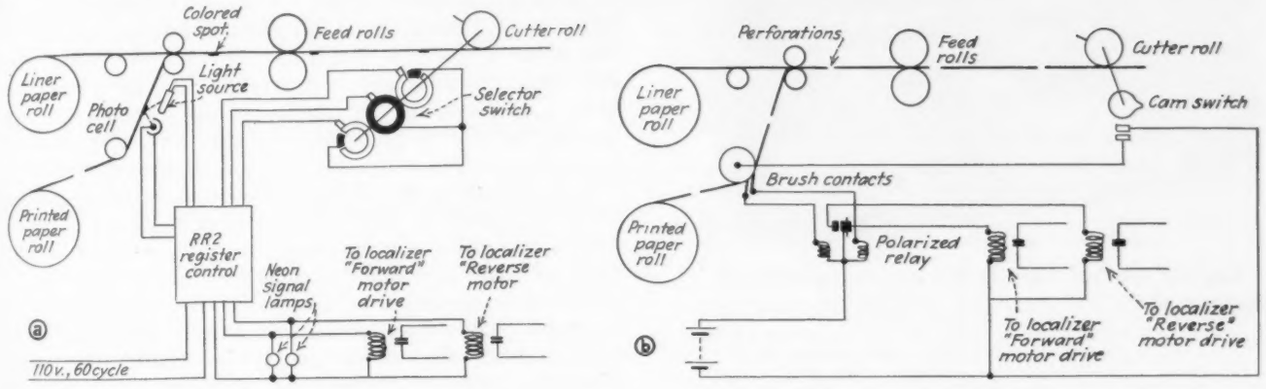
The photo-cell mechanism is here turned upward (at the upper left) out of its normal functioning position.



Either electric eye or brush contact method feasible for register control

(a) Photo-cell actuated by the colored spot adjusts the cutter so that print register is preserved. Works satisfactorily at 500 bags per minute.

(b) Brush contacts through paper perforations an alternative method of controlling register. Not so good for high paper speeds.



sary to advance or retard the feed-roll speed to compensate for these variations.

To accomplish this, the feed rolls are either speeded up or retarded for a small increment of time, enough to again place the print into substantially correct register. The well-known principle of rotating the stationary or reaction member of a planetary gear, thereby changing the speed of the output shaft, is made use of for this purpose. The stationary member of the localizer is driven manually, mechanically or electrically through a self-locking device, which normally holds this member in the fixed position necessary to obtain a constant speed ratio between the cutter and the feed rolls.

There are three principal methods for correcting the register as follows:

(a) *Manual*—By means of a lever-operated reversing friction drive or a handwheel drive to the localizer, which is actuated in the desired direction by the operator, whenever the print moves up or down on the bag.

(b) *Electrical Contact*—Through a motor drive to the localizer actuated by an electrical contact made between a brush and a metal roll, whenever one of the perforations made in the paper relative to the print passes between them. This takes place only when the print is out of register.

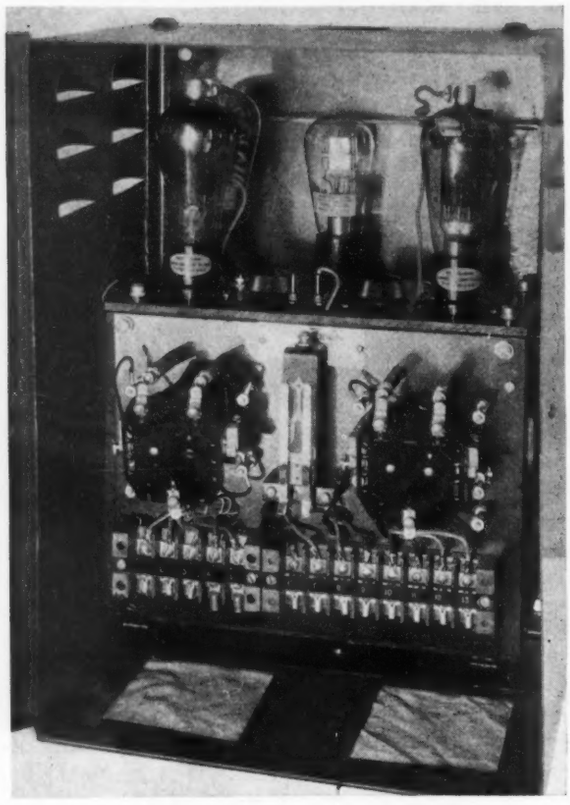
(c) *Photo-Electric Cell*—Through a motor drive to the localizer actuated by the change in illumination on a photo-electric cell whenever a perforation or a colored spot printed along the margin of the paper sheet, relative to the print, passes through a spot of light focussed on the margin. This takes place only when the print is out of register.

Manual localizing or register control requires the constant attention of the operator to hold the bags in register, and even then this cannot be kept very close. Due to the operator's attention being distracted and the usual fatigue of the eye and mind as the day advances, the amount of waste is high, as all bags that are out of register must be scrapped. This condition exists at bag speeds of 150 to 200 per minute, and it is obvious that at speeds of 200 to 350 per minute manual localizing becomes harder to accomplish and the amount of waste may be expected to increase accordingly. Hence with the higher speed automatic bag machines this method must be abandoned, and even for the slower speed machines it is not economical.

Drawbacks to contact type of control

The electrical contact method of localizing has a number of drawbacks and is limited in speed of operation where magnetic relays are used. Perforations are required through the paper along the margin of the sheet and this margin is used as the under part of the glued seam of the bag tube. Therefore, when the bag is unlined, difficulty is experienced in keeping the bag from being glued shut at the point where the perforation is located. The contact brushes riding along the margin of the sheet will pick up paper fuzz on their under surface, and after enough of this piles up will form an insulator, rendering the system inoperative.

Sometimes the perforations are not completely cut out, causing the paper disk to stick and preventing the brushes from making contact for the required correction until the next clear perforation comes along. The perforation is usually $\frac{1}{4}$ in. in diameter, which at a paper



Register control (RR-2) for use with photo-cell

Embraces grid glow tube, time-delay tube and amplifier

speed of 300 ft. per minute, corresponding roughly to 300 bags per minute, permits a maximum length of contact time of 0.0042 second. This is not enough to permit a contactor to close the circuit to the correcting motor. In order to overcome this a very sensitive type of polarized relay is used which stays in the closed position for either direction of correction, until a correction in the other direction is required. This feature in itself is objectionable in that the localizer is continuously overtraveling in either direction. In other words, once the relay is closed, it will continue to correct the speed in that direction until the relay is closed to the other side. As the paper speed is increased the time of contact becomes correspondingly faster until the sensitive relay is not energized long enough to close.

This method of localizing can be made to operate fairly satisfactorily with consistent results for speeds up to approximately 275 bags per minute. However, the maintenance of the contacts, moving parts and relays is very high and the waste due to failure of these is appreciable unless they are closely watched and inspected at frequent intervals.

Photo cells used with colored spots

The photo-electric cell method makes use of the RR-2 register control as developed by the Westinghouse Electric & Manufacturing Company for bag machines and other cut-off operations. This control permits the use of either a photo-electric cell or contacts to initiate the operation of the grid glow tubes and other electronic tubes which determine the direction and length of time of the correction. The contacts can only be used where the paper is perforated, and then contact is made similar to the electrical contact method; this, of course, is open to the same objections, in so far as dirty contacts and imperfect perforations are concerned. The photo-electric cell may be actuated from either perforations in or printed colored spots on the paper. In the case where a colored spot is printed along the paper margin or between the prints the photo-electric cell, the light source and optical system are all included in a self-contained scanning head, which can be located at some convenient place back of the feed rolls. This scanning head is on an adjustable frame which permits moving it in or out to suit the location of the spot and away from or toward the paper to obtain the best light focus on the paper.

Localizer actuated by spots on paper strip

The contacts or photo-cell operate in conjunction with a three-ring commutator or selector switch directly coupled to the cutter shaft. The center ring, which is solid, is connected to an insulated segment in each of the outer rings. A brush is provided for each ring and these are mounted in a straight line on a common arm. The insulated segments in the outer rings are located relative to each other so that only one of them is in contact with a brush at a time, and a neutral space is provided about the width of the brush or wider, where neither segment is in contact with a brush. The segments determine the direction of the correction to the feed roll, and if a brush is making contact with one of these when an impulse is received from the photo-cell or contacts a correction will be made. The paper is in register when the brushes are in the neutral zone at the time the impulse is received, hence no correction is made.

The impulse as received from the photo-cell or contacts whenever a spot on, or a perforation in, the paper passes by is amplified by an amplifier tube, and if the selector switch is closed in either direction will change the grid voltage to either of two grid glow tubes, allowing the tube to break down and pass current. The grid glow tubes each directly controls a contactor which closes the circuit to the motor drive of the localizer, for the proper direction of register correction. The breakdown of the grid glow tube is substantially instantaneous so that the contact time or time of change in light intensity to the photo-cell is not a major consideration, and register control for up to 500 bags per minute can easily be attained.

Once the grid glow tube breaks down it will continue to pass current and the contactor will remain energized, making a correction, until its circuit is opened by some means. This affords an excellent opportunity for the use of a time-delay element which sets the time of correction by opening the contactor circuit after a given time. Another electronic tube having an adjustable time dial in its grid circuit is used for this purpose. The dial can be set from practically zero time to several minutes in very small steps, thus affording a wide range of time delay and providing a convenient easy way to adjust this to the value best suited for the operating speed and for each grade and kind of paper which may be put on the machine.

Neon signal lamps can be arranged in conjunction with the contactors to indicate the direction and the time of correction.

The RR-2 register control with photo-electric cell.

which is operating very successfully on a number of automatic bag machines of different makes, has given an excellent account of itself in increased production and decreased waste. Its response to printed spots of nearly all darker-hued colors is excellent and it will hold the register to $\frac{1}{16}$ in. plus or minus or better. For reds and other lighter-hued colors a differential type of scanning head using two photo-cells is used, and this, together with the control, is known as the RR-3 register control.

Use of automatic as against manual register control has greatly increased production in that a higher bag speed can be used, the waste has been reduced in some cases from as much as 6 to 7 per cent to $1\frac{1}{2}$ per cent or less and the operator can direct his attention to setting up new supply rolls of paper, attend to his glue vats and rolls, adjust the brakes on the supply rolls, adjust the speed changer, examine the finished bags for defects, etc., with perfect confidence as he knows the register will hold.

Simple Sketches an Aid in Laying Out Conduit

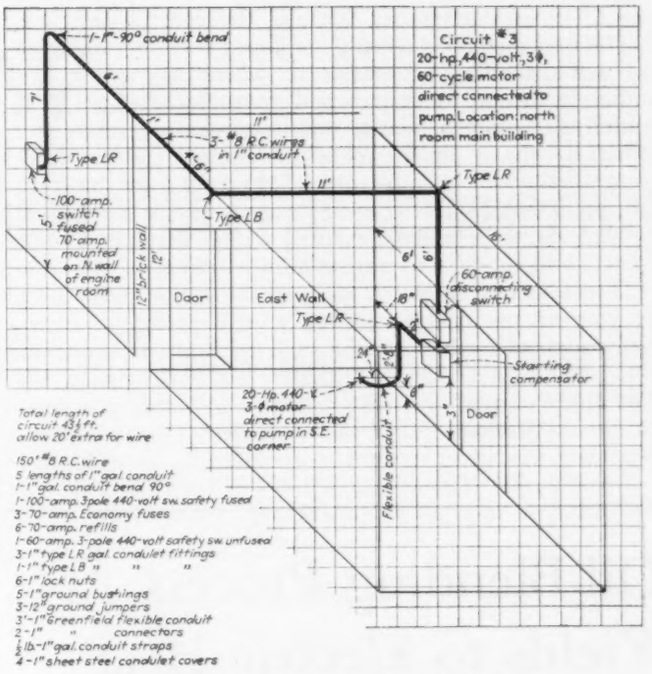
By K. B. HUMPHREY
Waterloo, Wis.

In estimating quantities of wire, conduit, etc., required for a given power or light installation the method outlined here has been found to work out very satisfactorily. The average contractor does not give sufficient time and attention to actual figuring on the job and consequently there is either a surplus or shortage of material. A shortage may cause a serious delay if the job in hand is not close to a source of supplies, while a surplus may mean money tied up in stock. The method which has been worked out makes use of ordinary cross-section paper to show how the conduit and wiring will be put in and to allow taking off quantities and materials required directly. The only measurements which have to be taken on the job are the sizes of the rooms, the location of switches and the position of the motor or other apparatus to be connected.

In the diagram illustrated the circuit switch and fuses are located in a room adjoining the room where the motor is located and all is included on one work sheet. In cases where the wiring is more complicated two sketch pages or more can be used, one for each separate room. The material list is made on the same sheet as the drawing and shows the actual material required for that sheet. Where there are several sheets the lists can be consolidated on a single sheet for estimating and ordering the material. By placing carbon paper in back of the sketch, one or more copies of the layout can be made.

When the material is on hand and the job ready to go ahead it is only necessary to give the electrician the sheet covering that room and issue the material shown on the sheet. The sheet shows the location and type of fitting to be used, the length of conduit and everything that is needed to be known; even the starting point may be indicated if desired. The original sheet should be filed with the records of the job, and should there be any questions afterward regarding the circuit the data are in a form which can be easily found.

There is little difficulty in making the drawings once the estimator becomes accustomed to the general idea.


1-1"-90° conduit bend
Circuit #3
20-hp. 440-volt, 3φ, 60-cycle motor direct connected to pump. Location: north room main building
3-#8 R.C. wires in 1" conduit
Type LR
Type LB
100-amp. switch fused 70-amp. mounted on N. wall of engine room
12" brick wall
Door
East Wall
60-amp. disconnecting switch
Starting compensator
20-hp. 440-v. 3-φ motor direct connected to pump in S.E. corner
Flexible conduit
Total length of circuit 43½ ft. allow 20' extra for wire
150' #8 R.C. wire
5 lengths of 1" gal. conduit
1-1" gal. conduit bend 90°
1-100-amp. 3 pole 440-volt sw. safety fused
3-70-amp. Economy fuses
6-70-amp. refills
1-60-amp. 3-pole 440-volt safety sw. unfused
3-1" type LR gal. condulet fittings
1-1" type LB " " "
6-1" lock nuts
5-1" ground bushings
3-12" ground jumpers
3'-1" Greenfield flexible conduit
2-1" " connectors
½ lb.-1" gal. conduit straps
4-1" sheet steel condulet covers

Isometric drawing to scale aids layout

An isometric drawing is made of the outlines of the room or rooms in which the installation is to be made. It will be observed that all lines are parallel to the cross-section background or to the diagonals so only a straight-edge or ruler is required. The same scale (one side of square = 1 ft.) is used on all of these lines so that when the conduit runs are laid out the amounts may be scaled directly off the drawing. If a conduit runs diagonally across a wall, ceiling or floor a true plan or elevation of that section will have to be drawn to show true length. If there are obstacles to be avoided it is advisable to indicate their exact position in the drawing. Doors or windows need only be indicated when they are used to locate equipment or orient the room.

Synchronous Motors Beat the Voltage Dips

Since synchronous motors are frequently used to handle the fundamental heavy load in industrial plants, it is often of primary importance to keep them running through momentary voltage dips. A shut-down is usually inconvenient and expensive and may be a serious safety hazard. So spoke C. R. Zimmerschied,* Electric Machinery Manufacturing Company, recently in suggesting the following means of avoiding unnecessary shut-down of machines.

With standard automatic control using a.c. operated and latched solenoids energized from the same source as the motor a comparatively small voltage dip will cause them to drop out and disconnect the motor. This can be prevented in two ways: (1) By time-delay under-voltage-release push button, or other delayed undervoltage relay or mechanical timing device; (2) by the

Before New York Power Group of A.I.E.E.

use of direct current for latching the control switches.

The first method is usually employed with motors driving self-unloading equipment or where the motor has sufficient torque to restart and resynchronize, as with centrifugal pumps, fans, motor-generator sets, etc. When a voltage dip occurs which permits the a.c. contactors, relays or latching magnets to drop open the start button maintains the starting control circuit for about 1½ seconds, so if voltage returns within that period the control will function as during intial starting.

Direct-current latching, to maintain motor connection as long as practicable through a voltage dip, is especially applicable when driving such machines as ammonia compressors and other equipment not easily unloaded. The direct current is usually taken from the same source as the excitation. Even when taken from a motor-generator the direct current is available for considerable time after an a.c. voltage dip, due to the gradual deceleration of the set. It is better, however, to equip an induction-motor-generator starter with delayed under-voltage release so the set will continue to rotate even though at reduced speed. With d.c. latching the a.c. line breaker and field contactor are both held closed by direct current, so the motor will continue to operate through a momentary voltage disturbance unless sufficiently severe to pull the motor out of step.

Automatic unloaders have been developed for a wide variety of synchronous motor applications, including compressors, reciprocating pumps, and pulp grinders, to permit automatic resynchronizing of motors which do not have full-load pull-in torque. It is often desirable to use d.c. latching in addition to time-delay push buttons with these devices, to eliminate complete stoppage of the machine except in cases of severe voltage dips.

Oil-Blending Process Yields to Electric Heat

By M. A. de LEW
Electrical Engineer Associated Oil Company, San Francisco

Satisfactory blending of lubricating oils by means of electric heat has been accomplished by the Associated Oil Company in a newly designed installation at its Shanghai, China, bulk plant. Local restrictions precluded the use of any other type of fuel.

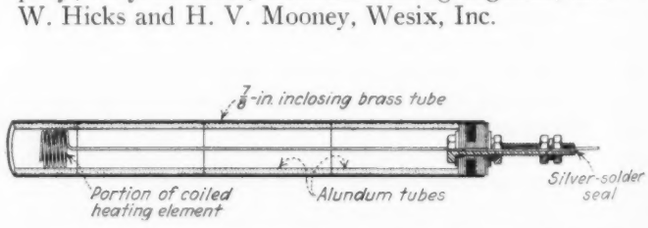
Heater design was based upon a duty of raising the temperature of 50 gal. of lubricating oil 50 deg. F. every minute and the surface condenser principle was adopted as the most feasible from both a mechanical and electrical standpoint. While built along conventional lines, the heater was considerably elongated for the purpose of imparting heat slowly, since the heating surface had to be limited to nine watts per square inch of tube surface to prevent carburization.

Total capacity of the heater is 120 kw., made up of 30 electrodes 11 ft. 6 in. in length. A unique type of construction was developed for the electrodes. Element wire was wound on a mandrel to give a tight coil 5 ft. long. This was then stretched to 10 ft. and insulation in the form of ¾-in. outside diameter by ½-in. inside diameter alundum tubes each 2 in. long placed over the coiled wire. A ⅞-in. brass tube was then slipped over this assembly and sealed against admission of either moisture or air. Sealing was accomplished by means of a silver-soldered brass washer insulated with mica held under pressure by means of a stainless steel terminal bolt, which was drilled to accommodate the element wire. Before sealing the electrode was brought up to 600 deg. F. and held at that temperature for 30 minutes to exhaust air and moisture. While this temperature was maintained the element wire was jammed in the bolt hole and silver soldered.

Power service at the Shanghai plant—380 volts, 50 cycles, three phase—considerably simplified the electrical work. The 30 electrodes were star-connected through varnished cambric conductors, each of which terminated in a General Electric Type AF-1 thermally controlled circuit breaker, which permitted individual operation of each electrode.

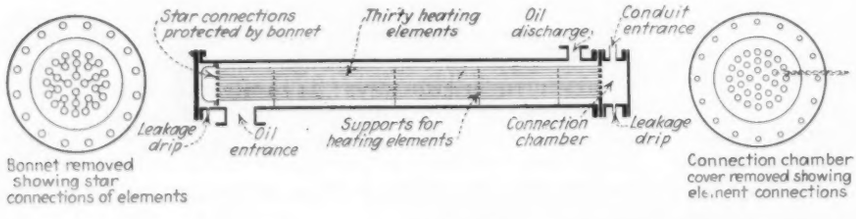
Temperature control is manual. In the blending process elemental oils are pumped from yard storage tanks in proper ratios into the heater, and through it into the blending tank. When both are charged the system is totally closed by shutting off connections from the tanks. The recirculating pressure system is then employed until a stable compound is produced. Maximum operating temperature is 250 deg. F. Oil temperature is controlled by changing the speed of the recirculating pressure pumps, which are driven by varispeed motors, or by varying the number of electrodes energized.

The heater was designed by the company's engineering staff in San Francisco and constructed and tested in the shops at the Avon refinery. Assisting in the design were W. C. North, International General Electric Company; A. J. Kercher, electrical heating engineer, and W. W. Hicks and H. V. Mooney, Wesix, Inc.



Terminal of one electrode showing method of sealing

The initial 6 in. of electrode contains no coiled element wire as circulation of oil is restricted at the ends of the heater.



Cross-section of electrically heated oil blender

Thirty 4-kw. tube-type electrodes are used, the terminal end of one being shown in the illustration above.

Illinois Finds a Way to Speed Rate Adjustments

By IRVIN ROOKS and HARRY R. BOOTH*
Attorneys Illinois Commerce Commission

Under emergency legislation Illinois has taken to fixing rates for electrical service on a basis which offers action at once and full hearings later.

Inability of the utility to pay dividends out of current earnings is not the measure of "fairness" used.

Fair return on the basis of true investment becomes the test.

IF REGULATION is to be strengthened and public confidence restored the following program would seem to be necessary at this time:

1. The principle of reproduction cost as the dominant element in determining fair value must be eliminated and the theory of prudent and honest investment in properties must be substituted as the measure of fair value. It may very well be desirable that state statutes be enacted declaring that prudent investment serve as a basis of determining the value for rate-making purposes of future investments in utility property. Such a statute, if not made retroactive, could probably survive constitutional attack.
2. Judicial review must be limited to determine whether, on the basis of record before the commission, constitutional rights of the utilities are violated.
3. Authority should be conferred upon state commissions to fix rates by temporary order pending complete investigations. The rights of utilities could be adequately protected by a recoupment provision such as is found in Section 36 of the Illinois public utilities act.
4. The state commissions must be equipped with technical staffs of ability and of sufficient number to make complete investigations of utility operations, and the cost of such investigations should be assessed against the utilities.
5. Accounting classifications should be revised to reflect actual cost of property built or acquired.
6. Operating expense accounts should be subdivided to reflect the true cost of serving the individual classes of consumers so that rates may be accurately determined.
7. Holding company relations must be placed under absolute supervision and control.

In the final analysis, utility management has it within its own power to respond to the critical situation now facing the industry and the regulatory authorities by voluntarily making all adjustments necessary to assure public confidence in state regulation and private operation. Some of the policies which should be adopted are:

(a) The consent, by negotiation and conference, to reasonable public demands for lower rates, a course which fortunately has been adopted by a few progressive companies and which can only result in increased business and enhance public relations.
(b) The elimination of all intermediary holding and affiliated companies not absolutely essential to good service.
(c) In general, the demonstration that the primary purpose of the industry is honestly to serve the public interest and not merely that of private and personal profit.

What is needed is a method of rate regulation that will result in prompt adjustment and which at the same time will avoid the expense and delay of appraisals and valuations. This need is particularly felt during times of rapid price fluctuations and abnormal business conditions, such as have existed during the past several years. Immediate efforts should be directed to eliminate the burden placed upon the state commissions arising out of the strict application of the reproduction cost doctrine. Judicial principles of fair value have apparently been construed to require an inventory and appraisal as a condition precedent to arriving at a rate base. If proper regard for these principles imposes such a requirement, the only solution would seem to lie in endeavoring to obtain from the courts or by legislative enactment a complete repudiation of the reproduction cost theory and the substitution of prudent investment or historical cost as the dominant element in determining fair value. As long as the court decisions have given considerable weight to reproduction cost in determining fair value, it is suggested that the time and expense required in the making of appraisals may in some cases be eliminated by the use of authoritative national and local construction cost and other indices.

Prudent investment fair to company and consumers

Let us consider first the merits of prudent investment. Does it offer a way out to the state commissions of what frequently appears to be the almost insoluble problem of valuation?

Both the Massachusetts and California commissions have, notwithstanding the absence of judicial support, had the courage to follow this principle through many years of regulation. More than any other state, Massachusetts has been able to avoid appeal to the courts, while the California commission's rate decisions have been sustained with few exceptions in both the state and federal courts.

After the original cost has once been determined by a careful audit, the fair value on this basis should be readily determinable at any time without the delay incident to an inventory and appraisal. The books of the utilities must be made to reflect the actual cost at the time of the installation of the property wherever such cost can be determined. All write-ups as a result of intercompany transfers should be eliminated. The basic value, thus once established, should not fluctuate from year to year

**Excerpts from paper presented before recent meeting of Association of American Law Schools at Chicago.*

with changes in the price level. Prudent investment is fair to consumer and investor alike, relieving the former of the duty of paying rates on inflated values and the latter of the risks of diminishing security because of changes in the price level.

Books must show true investment

But it can hardly be expected that prudent investment may be practically applied by the state commissions without a comprehensive revision of existing accounting classifications. It is regrettable that despite the fact that commission regulation was established in various states twenty to twenty-five years ago, a period which is practically equivalent to the life of an electric utility, for example, too many commissions are today unable to ascertain actual investment in utility properties, a condition which would not obtain had uniform systems of accounts been established and properly supervised by the regulatory authorities from the beginning.

Coming now to the question of finding fair value through the use of indices, we should note that this means of establishing fair value is still in its experimental stage. While indices reflecting various types of commodity, material and construction cost changes have been prepared by unbiased government bodies, such as the United States Department of Labor and other agencies, in only a few instances have they proved of substantial aid to commissions and courts in determining fair value.

Of more than ordinary importance may be the recent decision of the Maryland Public Service Commission fixing rates for the Chesapeake & Potomac Telephone Company of Baltimore City, where the rate base was arrived at almost solely as a result of trending a former finding of fair value by the use of a number of indices.

Fifteen basic price trends were offered by the people's counsel in behalf of the commission in this proceeding; five were based upon commodity prices, five upon the cost of building construction, two upon prices of building materials, one upon wages in Baltimore and vicinity, one upon a weighted combination of general commodities and one upon cost of telephone and telegraph lines owned by railroads. It is to be hoped that, notwithstanding the fact that the Federal District Court of Maryland has restrained enforcement of the order, commissions will continue to study the use of indices. The development of accurate local construction cost indices by competent technical staffs may ultimately serve to shorten the task of finding present value under the reproduction cost principle. Of course, it goes without saying that indices as basis for valuation must reflect any actual change in general price levels. If in any individual industry an artificial condition is maintained, which is contrary to the general economic situation, an index based upon this industry alone would obviously have to be carefully scrutinized before attaching any weight to it.

Specific statutory provisions authorizing emergency rates have not always been deemed necessary for temporary increases, though at least four states, New York, Indiana, Wisconsin and Illinois, confer definite authority upon their commissions to fix rates by temporary order. The statutes of the first three states are somewhat similar in character, the Wisconsin and Indiana laws declaring that when the commission finds that an emergency exists it shall have the power temporarily to alter or amend existing rates in order to prevent injury to the utilities or to the public.

The Illinois law, amending Section 36 of the public utilities act, enacted this year represents a distinct departure from these statutes and has been carefully designed to provide for emergency orders which will be sustained by the courts. For this reason we think it deserves separate consideration. It provides that whenever the commission finds, after an examination of the company's books, records and reports, that the net income of the company, after reasonable deductions for depreciation and other reserves, is in excess of the amount required for a reasonable return upon the value of its used and useful property, and a hearing would take in excess of 120 days, that an emergency exists and the commission, after notice, may fix a temporary schedule of rates. The moderate character of the amendment is indicated by the fact that the reduction may not exceed the amount found to be in excess of a reasonable return, that the temporary order may not remain in effect for a period exceeding one year, and that, if upon final disposition of the case in a court or commission a rate higher than the temporary one is fixed, the company may recoup the difference.

In the first important proceeding instituted by the Illinois Commerce Commission under this section the commission construed the law as requiring a formal hearing. In this proceeding the commission voluntarily sought to establish the unreasonableness of charges collected by the utility. Its experts, following an examination of the company's books, records and reports, developed two tentative rate bases, one predicated on historical cost and the other on reproduction cost trended. Three weeks' time was allotted the company to study the evidence offered by the commission's experts and to prepare for cross examination and an additional period of at least four weeks to present the company's own case. If, after cross-examination of the company's witnesses and short rebuttal testimony upon behalf of the commission, that body is convinced that the present rates are excessive, a temporary rate reduction would seem to be in order and the case would proceed as any other case for the purpose of establishing a permanent rate. Such a course would be eminently fair to the consumers since they would benefit by an immediate rate reduction and the company's rights would be protected, since if the commission, after the complete investigation, found the temporary rate too low, the company would be allowed to recoup the difference between the final rate and the temporary one.

Dividends not an adequate criterion

All the commissions are not agreed as to what are to be the primary considerations in determining whether a temporary rate reduction is to be entered. Must a commission determine within reasonable limits the fair value of the property of a utility and allow a reasonable return upon that value, or shall a commission follow the view taken by Chairman Maltbie of the New York Public Service Commission in the recent order directing an emergency rate reduction of the electric companies serving New York City, that the "principal consideration in fixing immediate temporary rates is the ability of the corporation to operate under such rates and to pay reasonable dividends in view of existing conditions?" The Wisconsin Public Service Commission in its order of July 1, 1931, directing a statewide reduction of telephone rates, took very much the same position when it emphasized the fact that temporary rates could not be said to be confiscatory if they enabled the

company to pay its operating expenses, fixed charges, a reasonable dividend upon its common stock and allow a small sum for its surplus.

While it is true that the financial condition of a utility and its ability to pay reasonable dividends to its stockholders should be given reasonable consideration by a commission in determining whether a temporary rate order is to be entered, we cannot agree that this is properly the principal consideration. The wiser policy would seem to be to determine fair value on the basis of historical cost supported by trended reproduction cost and to allow a fair return to be determined by the facts of each individual case. Where operating companies have been milked by affiliates, or where their surpluses have been dissipated as a result of speculation, or where operating expenses have been increased in order to build up deficient reserves, it would seem to be unfair to condition a temporary rate upon the ability of a utility to pay dividends. Furthermore, many companies are now overcapitalized, as few commissions have limited security issues to actual investment as have the California and Massachusetts commissions.

Admitting the obligation of commissions to protect the investor, it would seem that, where the stockholders' equity has been dissipated by imprudent management or diminished by excessive capitalization, the commission should not require the consumers to subsidize the stockholders by the payment of excessive rates and that temporary rate reductions should not be withheld because of the inability of such companies to pay dividends.

Analysis of Small System Allocates Energy Losses

That lost and unaccounted for energy can be kept at a low figure even for non-metropolitan systems was evidenced by data presented by M. A. Harpster, electrical superintendent Peoples Gas & Electric Company, Mason City, Iowa, at a recent meeting of engineers of the Iowa Public Utilities Association. The particular system for which Mr. Harpster gave a breakdown of loss data is one serving a city of 25,000 and nine smaller towns by means of 50 miles of transmission line. The figures are for one year of operation, during which the generation was 17,092,800 kw.-hr. The item of "miscellaneous losses" in the following table includes those due to theft of energy and to meter inaccuracies and failures of various kinds:

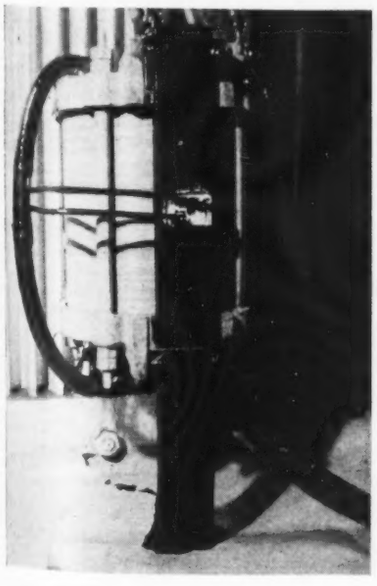
	Total Kw.-Hr. Loss	Per Cent of Total Generated	Per Cent of Total Loss
Transformer core loss	530,000	3.1	28.8
Transformer copper loss	190,000	1.1	10.3
Meter potential and current coil loss	80,000	0.5	5.0
Transmission line loss	270,000	1.6	14.7
Primary line loss	210,000	1.2	11.4
Secondary line loss	160,000	0.9	8.7
Other secondary losses	100,000	0.6	5.4
Miscellaneous losses	296,464	1.7	16.1
	1,836,464	10.7	100

Network Reactor Used as Current Transformer

Quick and accurate measurements of the currents flowing from secondary network transformer banks are frequently needed. As meters and current transformers are not always available for such measurements, the following measuring scheme was recently developed by the Tennessee Public Service Company, under the initiative of Chase Hutchinson, electrical engineer.

Approximately 30 turns of wire was wound through the standard 625-amp., 2-turn external reactors. These reactors are designed for 6.1 per cent impedance when used with 75-kva. transformers having a 4.9 per cent impedance. Current readings are taken with a standard graphic or indicating voltmeter. The indicated voltage is changed to amperes flowing by multiplying by a constant. Reference to the current-voltage chart shows that for the 625-amp. reactor the voltage-current line is practically straight up to 1,600-amp. turns through the reactor. For a 225-kva. bank relatively little error is introduced up to 150 per cent of bank capacity.

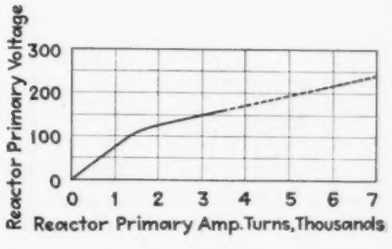
While actual voltage measurements across the 30 turns were not made under short-circuit conditions, the extended voltage-current line indicates that dangerously high voltage will not exist across the 30 turns during short circuit.

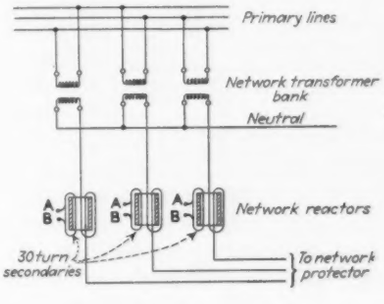


Typical installation for measuring current by secondary network reactor

Volt-ampere characteristic of 625-amp. reactor

This curve shows that the assumed **linear** voltage-current relation holds up to 1,600-amp. turns through the reactor, or 150 per cent of capacity (two-turn external reactors).





General scheme of reactor connections

A and B are terminals of the 30-turn secondary for attaching voltmeter to measure current flowing in main secondary. The indicated voltage must be multiplied by a constant to get primary amperes.

For a Better Use of Investment in Coupling Capacitors

By F. B. DOOLITTLE
Radio Engineer Southern California Edison Company, Ltd.

"By far the most costly item required for interlocking power channels at 220 kv.," the coupling capacitor may be so adapted to transmission protection that notable increase of investment efficiency results.

USE OF high-speed protection systems employing carrier current to interlock the relays at opposite ends of single transmission line sections has been found to be the most satisfactory means of obtaining adequate protection on the 220-kv. system of the Southern California Edison Company, Ltd. With the increasing demand for carrier channels for this service an opportunity is afforded to make substantial savings in the number of coupling capacitors required by using each for several purposes, particularly since the capacitors are by far the most costly item required for interlocking channels at 220 kv.

Gould substation of the Edison company affords an example of the efficient use of the minimum requirement of six 220-kv. capacitors. The minimum of six, the arrangement of which is shown in Fig. 1, is established by the fact that three-phase potential for relay operation is required from each of the two buses, there being no 220-kv. step-down transformers at this switching station. In addition to the six potentials, the same capacitors provide interphase coupling to the Vincent transmission line for pilot protection and phase-to-ground coupling to each of the Laguna Bell lines for pilot protection.

The Vincent pilot protection and the carrier telephone were originally installed with interphase coupling. A test made with the Vincent pilot protection showed phase-to-ground coupling about 70 per cent as efficient as interphase. Phase-to-ground coupling saves one capacitor and one trap at each terminal, but requires a slight increase in carrier power to maintain the same signal level. The increased power is available at a small fraction of the cost of a coupling capacitor and therefore phase-to-ground coupling is used on all the new carrier pilot protection installations.

Carrier-frequency energy is confined to the desired 220-kv. lines by the use of resonant traps in series with circuits from which a particular carrier frequency is to be excluded. It is desired that carrier telephone communication shall be possible via the Vincent line, the Eagle Rock line or the Saugus line and over these lines in combination. The coupling for this purpose is made to A and B phases of each bus through the tuning units marked *T* and the double-trap units marked *D* in Fig. 1. The carrier telephone energy is excluded from the East and West Laguna Bell lines by the resonant traps marked *T* in the A and B phases of these lines. One reason for keeping the telephone carrier off of the Laguna Bell lines is that any energy going this way is

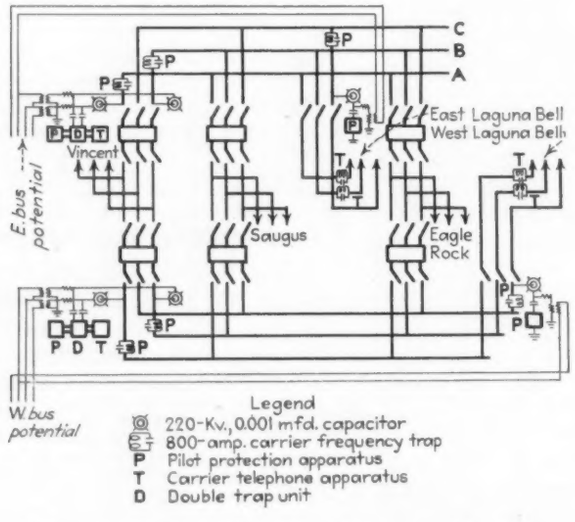


Fig. 1—Six coupling capacitors provide four carrier channels and six potentials

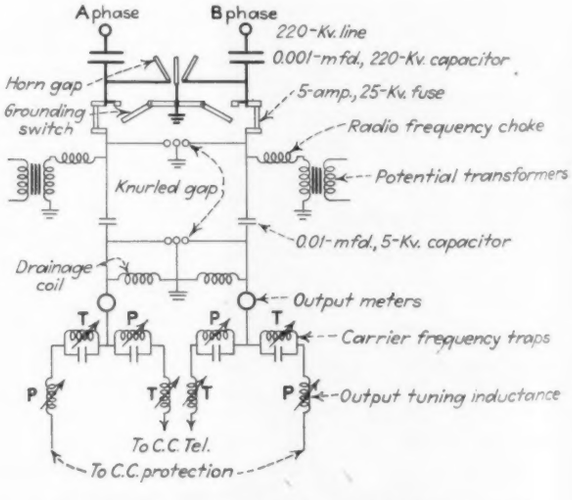


Fig. 2—Apparatus for potential supply and two carrier-frequency channels

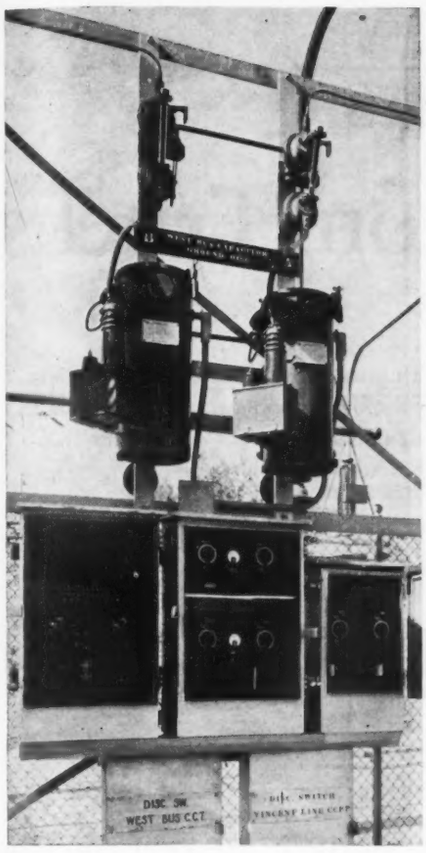
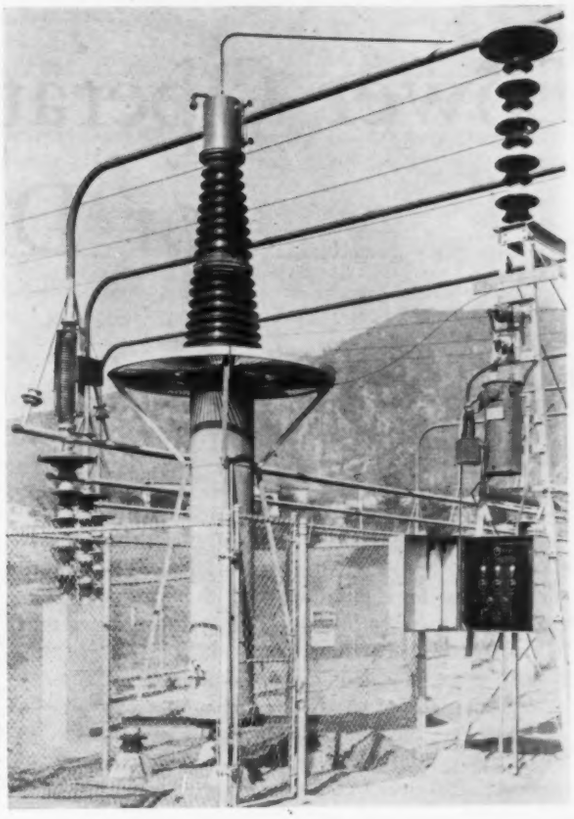


Fig. 3—Provides potential supply and two carrier-frequency channels

Double trap units are in the center cabinet. Output tuning inductances for pilot protection and telephone frequencies are in the right and left cabinets, respectively. Above the cabinets are the A and B phase potential transformers and the auxiliary 0.01-mfd. capacitors. At the top are the grounding switches and protective fuses. See Fig. 2 for circuit diagram.



Carrier apparatus for one line and C-phase potential transformer

Carrier-frequency trap for the pilot-protection frequency is mounted in the vertical tap to the horizonal bus at the left of the main capacitor and the associated carrier apparatus at the right.

wasted, as there are no carrier telephone sets on the 220-kv. system south of Gould. A more important reason for telephone frequency traps in the Laguna Bell lines is to stop carrier frequency reflected waves from returning over these lines and arriving at the telephone receivers out of phase with the signal, resulting in serious impairment of the quality of speech reception.

Couplings for pilot protection on the Vincent line are made to A and B phases through the same capacitors used for the carrier telephone, but in this case traps tuned to the pilot protection frequency are used between the taps to the capacitors and the buses, as shown in Fig. 1. Thus the A and B phase capacitors on each bus are, in effect, on the Vincent line at pilot protection frequency and on the buses at telephone frequency and for potential supply. Similarly the capacitors for the phase-to-ground coupling on the Laguna Bell lines are on C phase of each bus for potential and on C phase of each line at the carrier frequency to which each trap is tuned.

Fig. 2 shows the circuit used with the A and B phase capacitors for the purposes just described. Starting at the 220-kv. line, the potential supply circuit includes first the 220-kv., 0.001-mfd. capacitors, which, at 50 cycles, have a reactance of about 3.2 million ohms. At a phase-to-neutral voltage of 128 kv. they will pass about 40 milliamperes of 50-cycle current to ground. This current flows principally through the radio-frequency choke coil and the potential transformer to ground, the impedance of this path being adjusted to approximately 57,500 ohms in order to supply 85 volt-amperes, while the impedance of the alternative path through the 5-kv., 0.01-mfd. capacitor is 320,000 ohms at 50 cycles. The radio-frequency choke coil in series with the potential transformer primary offers a high impedance to the carrier-frequency currents, which, therefore, flow through the 0.01-mfd. capacitor.

From this point the telephone and protection carrier frequencies are forced to take separate paths by the trap circuits marked *T* and *P*. Traps *P* are tuned to the protection frequency and offer a high impedance to it, which keeps it out of the telephone circuits. Similarly, traps *T* block the telephone frequency from the protection circuits. The variable tuning inductances marked *T* are tuned to series resonance with the coupling capacitors at the carrier telephone frequency, thus providing a low impedance path at this frequency from the carrier telephone output to the 220-kv. line.

Flexibility readily secured

Operating flexibility is not seriously hampered by the multi-purpose use of the capacitors. Relay potential may be obtained from either bus, hence one bus may be out of service without interrupting the supply. The carrier telephone and Vincent carrier pilot protection have duplicate coupling equipment and function satisfactorily over either path or through both in parallel. It is true that the coupling capacitors are not connected to the lines and therefore carrier-pilot-protection channels are interrupted when the line circuit breakers or disconnecting switches are open, but under these circumstances protection could do no good on this end of the line.

While the circuits involved may at first appear somewhat complicated, it is apparent from the foregoing that each component part has a very definite and simple function. Actual operating experience has shown that the saving in investment in capacitors made possible by using each one for several purposes is entirely justified.

Lower Operating Costs for Distribution Trucks

By C. F. RASMUSSEN
Walker Vehicle Company, Chicago

Not satisfied with guesses and preconceived notions as a basis for deciding upon future policy in the purchase of distribution trucks one utility company had a thorough analysis made by engineers.

Use the gasoline truck for suburban or rural work, for long trips where stops are few and where streets are not paved, was the conclusion, and

Use the electric for short runs where stops average more than one to the mile and where most streets are hard surfaced.

DURING the past five years many power companies have decided that although the use of electric trucks by customers is desirable, the gasoline truck is the logical equipment for utility work. This decision is usually based on two impressions: (1) The electric truck, according to the utility's interpretation of its own experience, is more expensive to operate; (2) the electric truck is too slow.

About one year ago a large utility on the Atlantic Coast, after analyzing truck-operating costs, was of the opinion that a fleet of 75 electric trucks should be replaced with gasoline trucks as soon as the electrics were worn out. At the same time the management realized that to dispose of these trucks would not induce its customers to buy new electric trucks to add to fleets already totaling close to 1,000. The investment in 75 trucks was worth consideration. It would require an outlay of $300,000 to $400,000 to buy that many gasoline trucks.

After careful consideration of the problem it was decided to call in an independent engineer and accountant who could be expected to approach the problem with an unbiased viewpoint. This article is based on the results of his investigation. All data were compiled by the company, analyzed by the engineer and checked by the auditing department of the company.

The analysis was based on the theory that a true comparison of truck-operating costs must cover trucks of equal capacity, age and mileage in the same type of service. Obviously, a 5-ton truck on heavy line construction in rural districts does not compare with a 2-ton truck on subway maintenance in a crowded city. Nor can a light truck traveling 20 miles a day in a downtown district be compared with another light truck traveling 75 miles daily in the country.

Comparative Operating Costs—The investigation showed that both gasoline and electric trucks can be used to advantage by a utility. The gasoline truck is in my opinion preferable for suburban or rural districts where traffic is thin, roads are unpaved or daily mileages are great. The electric is preferable and more economical in the larger cities. (See Table I.)

Local conditions and requirements vary, so the respective fields indicated cannot meet the needs of every utility. On the other hand, the territory of this particular utility is very extensive and includes some of the most densely populated sections of the country as well as typical suburban and rural communities. The experience of this utility, therefore, should be almost an ideal case from which to draw general conclusions.

Here is a summary of the results of the cost analysis:

Capacity	Total Operating Cost per Year — Gasoline	Electric	Gasoline Exceeds the Electric by — Amount	Per Cent
5-ton	$2,619	$2,091	$528	25
2-ton	2,144	1,627	517	32
½-ton	1,143	906	237	26

The details which make up these totals are shown graphically in Figs. 1, 2 and 3 and Table II. A few of the items of operating costs deserve comment.

Depreciation on gasoline trucks and electric storage batteries is based on actual life. Depreciation on electric trucks is based on an estimated life of twelve years. It

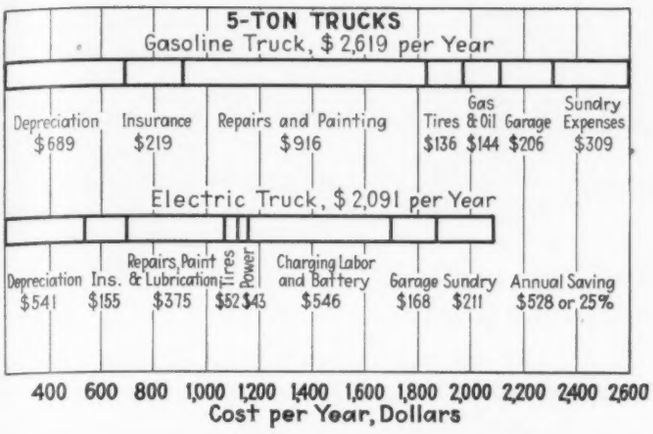
Table I—Logical Fields for Gasoline and Electric Trucks*

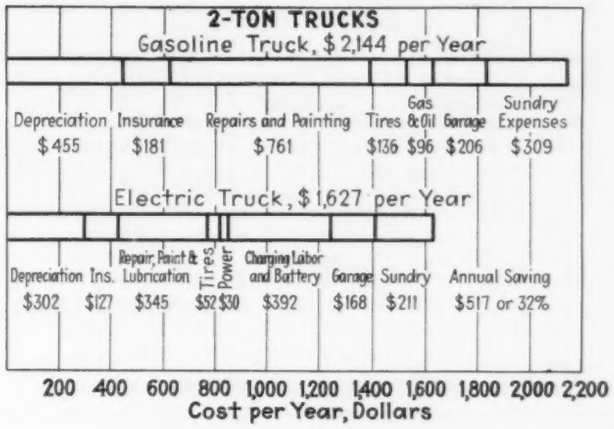
Use the gasoline truck for suburban or rural work, for long trips where stops are few or where streets are not paved.

Use the electric for short runs where stops average more than one to the mile and where most of the streets are hard surfaced.

Type of Work	Miles per Day — Electric — Average	Occasional Max.	Gasoline
3½ to 5-ton			
Line	15-20	30	Over 20 miles
Subway	15-20	30	Over 20 miles
Material hauling	15-25	40	Over 25 miles
Manhole cleaning	15-20	30	Over 20 miles
2 to 2½-Ton			
Services	20-30	45	Over 30 miles
Tree trimming	20-30	45	Over 30 miles
Light line construction	20-30	45	Over 30 miles
1½-Ton			
Services	25-35	45	Over 35 miles
Cut-ins/offs	25-35	45	Over 35 miles
Pickup and delivery	25-35	45	Over 35 miles
¼ to 1-Ton			
Lamp renewals	25-35	50	Over 35 miles
Lamp maintenance	25-35	50	Over 35 miles
Meter setting	25-35	50	Over 35 miles
Pick-up and delivery	25-35	50	Over 35 miles
Gas fitters	25-35	50	Over 35 miles
Network protector maintenance	25-35	50	Over 35 miles

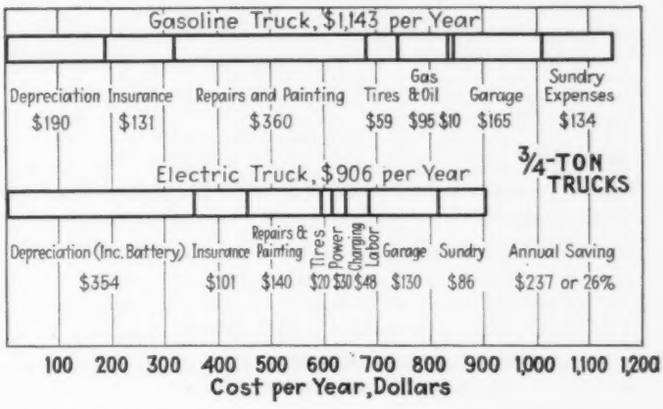
*Based on analysis of data presented in this article.





Figs. 1, 2 and 3—Comparative annual operating costs of three sizes of gas and electric trucks

Trucks in the same group were in similar service and operated under similar conditions. See Table II for details.



may be desirable to replace the electrics at that time with more modern equipment. Most of the electrics in the service of this company are now "orphans."

Gasoline consumption was studied in great detail to determine the variation in the amount of gasoline used at various numbers of miles per day (Figs. 4, 5 and 6). The cost of gasoline is not a fixed cost per mile. On the contrary, the per-mile cost of gasoline increases very rapidly as the mileage is reduced. For instance, with a 2½-ton truck operating 6 miles per day gasoline costs $0.0475 per mile or $0.285 per day and at 30 miles per day the cost is $0.014 per mile or $0.41 per day. The charts show clearly the effect of traffic on gasoline consumption. All figures are based on a price of $0.07 per gallon. Higher prices would increase all values proportionately.

Chassis Repairs—Chassis repairs are usually the most important item of truck-operating cost, and in this case amount to from 15 to 30 per cent of the total operating cost per year. Therefore, these costs were analyzed both as to truck age and daily mileage (Figs. 7, 8 and 9). The first chart shows that chassis repairs to the gasoline trucks increase very rapidly as the truck becomes older. Repairs to the electric increase for the first five or six years—but at a much lower rate—and thereafter decrease. Apparently after the first five or six years the electrics are in service all major repair work is completed and thereafter merely routine minor repairs are necessary.

It is not so evident why repairs are actually higher for a truck covering 10 miles a day than for one doing 20 miles (Figs. 8 and 9). Obviously the truck which covers 10 miles in a day is no more than 5 miles away from the garage at any time, therefore is continuously in dense traffic. Constant starting, stopping and gear shifting wear out a truck more quickly than operation on an open street or highway. The cost of chassis repairs for a 2-ton gasoline truck is $0.15 per mile, or $1.80 per day at 12 miles per day, and $0.07 per mile, or $1.75 per day, at 25 miles per day.

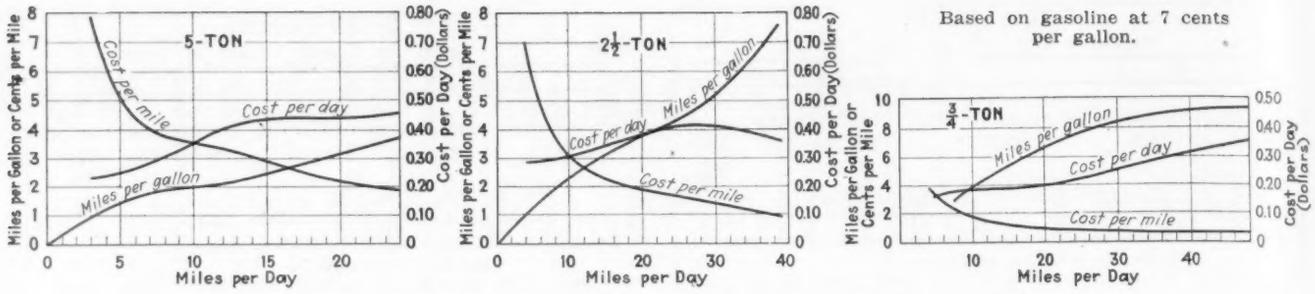
Mileage affects the cost of chassis repairs for an electric truck in the same way, except that the cost per day does not increase so rapidly as mileage is reduced. The figures prove that the electric is ideally fitted for short-mileage, frequent-stop service.

Table II—Comparative Annual Operating Costs of Gasoline and Electric Trucks

Based on operating records and costs over seven-year period

	5-Ton (10-Mile Day)		2-Ton (10.5-Mile Day)		¾-Ton (16.9-Mile Day)	
	Gasoline	Electric	Gasoline	Electric	Gasoline	Electric
Depreciation on chassis and body	$689	$495	$455	$256	$190	$324*
Depreciation on charging equipment	.....	46	.....	46	.....	30
Insurance	219	155	181	127	131	101
Repairs—Chassis	803	292	648	262	314	115
Body and painting	110	73	110	73	36	8
Accident	3	5	3	5	9	17
Tires	136	52	136	52	59	19
Gasoline or power	98	43	50	30	74	28
Lubrication	46	5	46	5	21	....
Battery—Labor	.....	164	.....	164	10	48
Depreciation	.....	382	.....	228	.....	....
Garage service and storage	206	168	206	168	165	130
Sundry expense	309	211	309	211	134	86
Total per year	$2,619	$2,091	$2,144	$1,627	$1,143	$906

*Includes battery depreciation.



Figs. 4, 5 and 6—How mileage per day affects gasoline consumption

Relative Speed—The apparent speed of a truck or automobile is misleading. For instance, one would imagine that traffic moves rapidly on a wide city street. One of the utility passenger cars recently was timed at 10:30 one morning. Traffic was relatively thin. At times this car was the only vehicle in a block. For a distance of approximately 100 ft. the car traveled at a speed of 30 m.p.h., and at all other times its speed was between 15 and 25 m.p.h., and usually less than 20. At no time did other vehicles pass, and from time to time the company automobile gained on other cars. Frequent checks show that between fifteen and twenty minutes is required to cover the 3.4 miles between the garage and the central repair shop, the average speed meanwhile being 10.2 to 13.6 m.p.h.

On the other hand, the driver of an electric truck is usually of the opinion that its speed is much less than an actual test proves to be the case. Possibly these misconceptions are due to the fact that the gasoline truck is noisy and the electric comparatively quiet. The engine of the gasoline truck may revolve faster in a low gear than in high. Furthermore, the faster vehicle often passes the slower moving vehicle, but both are held up by the same traffic light.

In order that the company might have definite data from which to determine the relative speed of the two types of vehicles, the operating department arranged to check the speed of trucks by means of service recorders which automatically chart the actual traveling time. The following precautions were observed in order to insure reliable results:

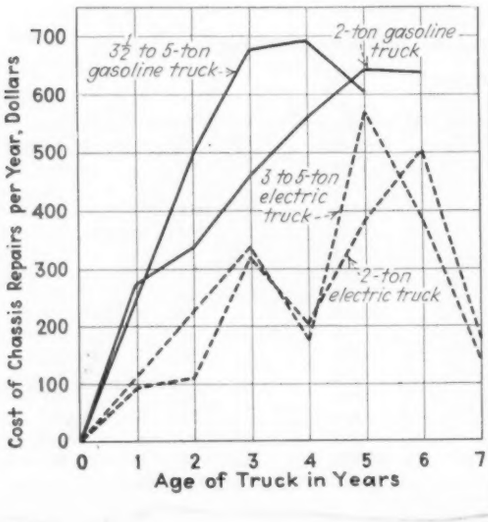
1. Ten recorders were provided, two for each of five different districts.
2. One recorder was installed on a gasoline truck and one on an electric in comparable service on the same days.
3. All trucks were assigned to regular work.
4. Each truck odometer was checked with a single automobile.
5. Four recorders were checked with a log of truck operation compiled independently by the gang foreman.

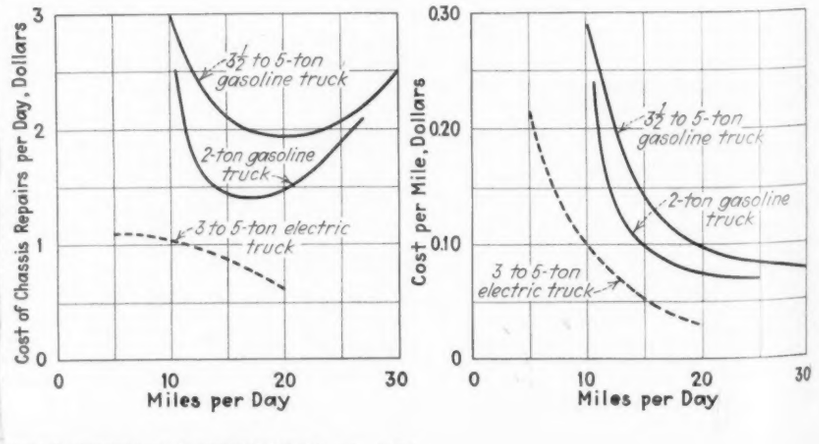
The results of these tests covering 118 truck-days are shown in Fig. 10. There is little difference in the speed of either type of truck or any make or capacity when compared for equal mileages and equal number of stops per mile:

Type and Capacity	Maximum Miles Per Hour Loaded	Average Miles Per Hour with Various No. of Stops per Mile		
		One	Two	Three
1-ton electric	16	12	10.5	10.5
1½-ton gasoline	30	12	No record	
2 or 2½-ton gasoline	22	10.5	7.5	6.5
5-ton gasoline	17.5	9.5	8.0	No record
5-ton electric	11	7.5	6.5	

The 1-ton electric with a maximum speed of 16 m.p.h. attained the highest average speed of the group with one or more stops per mile. It is 40 per cent faster than the 2-ton gasoline truck when stops are two to the mile and 60 per cent faster when stops average three to the mile. The 5-ton electric is somewhat slower than the 5-ton gasoline truck because its maximum speed is too low to offset the time lost in slow traffic. The company has taken steps to increase the speed of the 5-ton electric 1.5 m.p.h. with a possibility that it will then equal a gasoline truck of that capacity.

A utility is most interested in the comparative speed of the heavy-duty trucks used for line construction, subway maintenance and other work requiring a crew of


3½ to 5-ton gasoline truck
2-ton gasoline truck
3 to 5-ton electric truck
2-ton electric truck
Cost of Chassis Repairs per Year, Dollars
Age of Truck in Years


3½ to 5-ton gasoline truck
2-ton gasoline truck
3 to 5-ton electric truck
Cost of Chassis Repairs per Day, Dollars
Miles per Day
Cost per Mile, Dollars

Figs. 7, 8 and 9—Effect on chassis repair costs of age and mileage per day

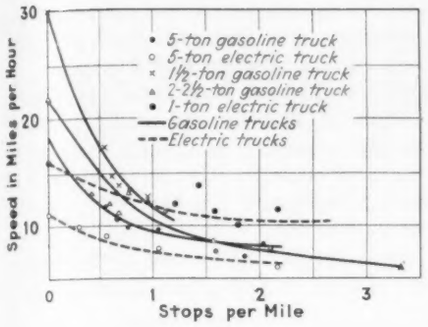


Fig. 10—Effect of stops per mile on average speed

Maximum speed of each truck shown by left-hand end of each curve.

six to ten men. The crew is ordinarily paid for traveling time as well as when at work. Fig. 10 shows that the 5-ton gasoline trucks are somewhat faster than the particular 5-ton electrics in the service of this utility. The time required to travel various distances at an average of one stop per mile is:

Miles Per Day	—Miles Per Hour— Gas	Elec.	—Minutes Traveling Time— Electric	Gasoline	Minutes Saved
5	9.4	7.8	38	32	6
10	9.4	7.8	77	64	13
15	9.4	7.8	115	96	19
20	9.4	7.8	154	128	26

Obviously considerable time is lost by the 5-ton electric on a 20-mile day, and the gasoline truck should be used for long runs. But it does not seem that a loss of six to nineteen minutes per day is at all serious for the following reasons:

1. The electric can easily be speeded up to equal the gasoline truck. Fig. 10 shows that an electric with a maximum speed of 16 m.p.h. is faster than a gasoline truck that will do 30.
2. Most of the 5-ton electrics upon which these figures are based are six or seven years old. The newer equipment can be speeded up at no cost to the company.
3. Nineteen minutes—4 per cent of an eight-hour day—is a negligible amount of time.
4. It is reasonable to assume that the gang requires some rest periods during the day and might just as well rest while riding from job to job.
5. If insufficient work were assigned to a truck and fifteen to thirty minutes were left at the end of a day before it was necessary to leave the job in order to arrive at the garage at 5 p.m., it is doubtful if this time would be used for useful work.
6. If too much work is assigned and the last job cannot be finished in time to arrive at the garage at 5 p.m. there might be a tendency to slow up the work in order to leave enough to make it worth while to come back the next day.

In conclusion, it would seem that when gasoline trucks are used in city traffic and in the same work as electric trucks, either type of vehicle is satisfactory from the point of speed. As a matter of fact, if the maximum speed of the electric is great enough, it can be the fastest type of vehicle in city traffic.

Advantages of Electric Trucks in Utility Service—The results of this investigation suggest the following advantages of the electric truck for power companies:

1. The operating cost of a gasoline truck is 25 to 32 per cent more than that of an electric truck of equal capacity for low-mileage, frequent-stop service.
2. The speed of either type of vehicle is approximately the same for low-mileage, frequent-stop service.
3. The absence of gasoline fumes from an electric truck has a distinct advantage in some cases: It is the usual practice in the morning for a driver to start the engine of a gasoline truck and let it run a few minutes before leaving the garage. As a result the garage is filled with carbon monoxide fumes.

When a gasoline truck is pulling cable and is spotted close to the manhole the fumes from the exhaust, being heavier than air, sink into the manhole to the discomfort of the workmen.

4. When the company uses electric trucks it has no out-of-pocket expenditure for gasoline.
5. The controlled speed of the electric truck has a tendency to reduce accidents. It is reflected in insurance rates.
6. The perfect control possible with an electric winch is of value for some types of work: (a) Heavy transformers can be raised or lowered a fraction of an inch at a time. (b) Three 350,000-circ.mil cables can be pulled into a 3-in. duct without damage to the insulation. In this particular case there is practically no clearance between cable and duct. (c) Wire can be pulled slowly and steadily to eliminate all possibility of whip.
7. The operation of the electric truck is not affected by cold weather. It is not necessary to keep the motor running while the truck is standing at a job.
8. The short wheelbase has a distinct advantage in crowded traffic.
9. The use of electric trucks has an important commercial value in its effect on customers. The utility recommends that a customer use electric elevators to move goods from floor to floor. Should he not use electric trucks to move those same goods on the streets? The electric truck load is entirely an off-peak load, therefore, very desirable. Sales resistance is undoubtedly increased unless the utility uses electric trucks in its own work.

Guying Guesswork Eliminated by Charts

By B. E. ELLSWORTH
Iowa-Nebraska Light & Power Company, Lincoln, Neb.

Elimination of old familiar approximations, and the questionable good judgment of the line foreman, places the guying of poles on a sound engineering basis if this graphical aid is used

GUYING is an important factor in the attainment of maximum life and strength of overhead lines. Therefore leaving the guy problem up to the line foreman and depending on him to say the anchor should go about here and the pole attachment ought to be about so high is not good practice. It is hardly practicable either for each and every guy installation to be the subject of an individual calculation. Thus is arrived at the need for the old stand-by of the engineer, the tabulation of data and the graphic chart for the quick solution of his problems. Here they are for the guying job.

Knowing the location of the anchor with respect to the pole, the vertical angle the dead end guy makes with the pole can be found from Fig. 2. Also the horizontal pull in line wires (which is one-half the ultimate tension of the wires in Table II) can be found from Table II if the number and size of conductors are known. In the right half (only) of Fig. 3 locate the horizontal pull on the pole in the right-hand vertical scale and follow horizontally until the proper "angle line" is intersected. Follow down the proper circle to the horizontal scale, where the actual tension in the guy is found.

Example—Anchor is placed 30 ft. from pole and guy attached 40 ft. above ground. From Fig. 2 the angle the guy makes with the pole is 37 deg. Six No. 2 triple-braid, weatherproof wires are to be dead ended with a conductor safety factor of two. From Table II this is found to be 5,400 lb. Following the 5,400-lb. line

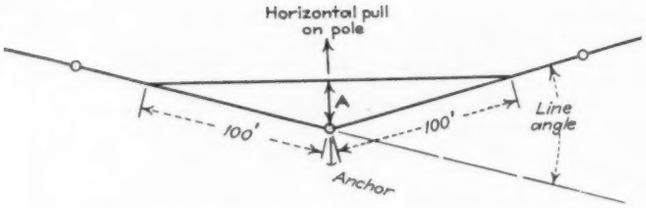


Fig. 1 and Table I—To determine line angle

Line Angle, Deg.	Length "A," Ft.	Horizontal Pull on Pole Per 1,000 Lb. Wire Load, Lb.	Line Angle, Deg.	Length "A," Ft.	Horizontal Pull on Pole Per 1,000 Lb. Wire Load, Lb.
5	4.4	87	35	30.1	600
10	8.7	174	40	34.2	684
15	13.1	260	45	38.3	765
20	17.4	347	50	42.3	844
25	21.6	432	55	46.2	923
30	25.9	518	60	50.0	1,000

horizontally in Fig. 3 (right side) until it intersects the 37 deg. line determines the actual tension in the guy of 8,800 lb.

An ingenious chart can be made by taking the right half of Fig. 3 and locating the various wire sizes and combinations along the vertical scale and the sizes of guy strand and anchors along the horizontal scale (using the proper guy and anchor safety factors). Such a chart can easily be mastered by the average line foreman.

The line plan diagram and Table I are used for slight line angles. From Table II find the horizontal pull in the line wires as in the previous example. Use this value in the left horizontal scale in Fig. 3. Follow the circle thus located until it intersects the line corresponding to the angle made by the line. This locates the horizontal pull on the pole. Project this value horizontally to the right and proceed as in the other example for the right side of Fig. 3.

Example—Angle line turn is found to be 40 deg., the side pull of which must be guyed for. Pull in line wires from Table II is found to be 3,900 lb. On left horizontal scale of Fig. 3 locate 3,900 lb. and follow up and around until it meets the 40 deg. line. Follow horizontally into the right half of Fig. 3 until it intersects the line corresponding to the angle the guy makes with the pole (as found in Fig. 2). If this angle is 43 deg., the actual tension in the guy because of the jog in the line is 3,900 lb.

Table II—Horizontal Pull in Line Wires, Pounds

(Safety Factor of 2)

Line Being Guyed		Horizontal Pull—Two Wires	Horizontal Pull—Three Wires
No. 6	Hard drawn bare	1,300	2,000
No. 4	Hard drawn bare	2,000	3,000
No. 2	Hard drawn bare	3,000	4,500
No. 1	Hard drawn bare	3,800	5,700
No. 0	Hard drawn bare	5,860	8,800
No. 6	Triple braid, weatherproof	760	1,140
No. 4	Triple braid, weatherproof	1,200	1,800
No. 2	Triple braid, weatherproof	1,800	2,700
No. 0	Triple braid, weatherproof	2,300	4,200
No. 2/0	Triple braid, weatherproof	3,500	5,300
No. 4/0	Triple braid, weatherproof	5,500	8,300
No. 2	A. C. S. R. bare	.....	4,000
No. 0	A. C. S. R. bare	.....	6,300
No. 2/0	A. C. S. R. bare	.....	8,000
No. 4/0	A. C. S. R. bare	.....	12,600

Shearing Pin Failures Indicated

Sharp-eyed visitors in the generating station of the Iowa Public Service Company at Waterloo, Iowa, frequently notice a white bob that marches with dignity up and down on the end of a string against the black face of a stoker gear case in front of one of the boilers. This particular piece of machinery is the operating mechanism of the clinker grinder on a Westinghouse stoker below the line of coal rams and somewhat farther in than they are. The string to which the bob is attached is carried over a small pulley mounted on the gear case and the other end is fastened to the ram of the clinker grinder. Shearing pins are inserted in stoker ram mechanisms so that they, instead of other parts, will break if a ram should encounter very difficult going. Since the clinker grinder is not out in plain sight the bob, which is, furnishes a continuous indication clearly visible to the attendant standing in the boiler aisle that the shearing pin of the ram is still intact and the clinker grinder is attending to its duties in a satisfactory manner.

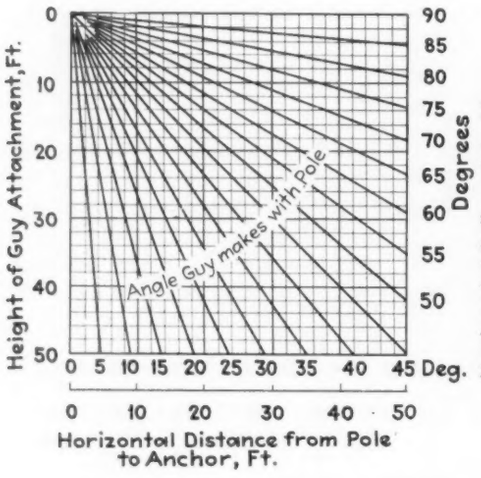


Fig. 2—Vertical angle of guy attachment

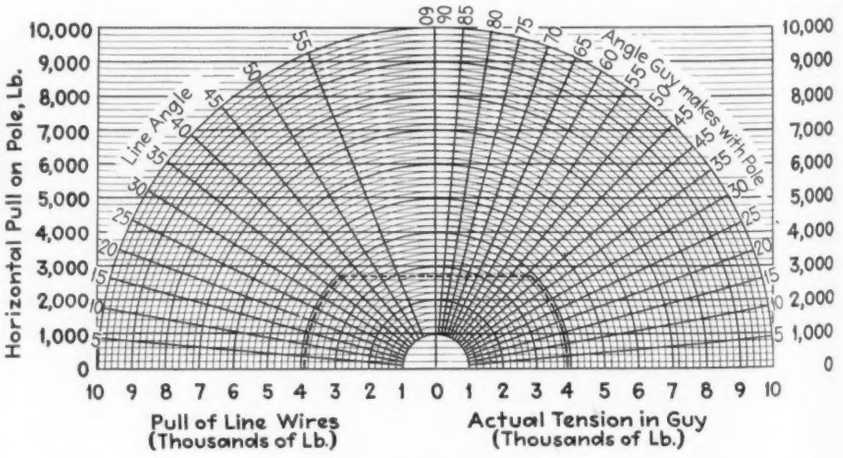

Horizontal Pull on Pole, Lb.
Line Angle
Angle Guy makes with Pole
Pull of Line Wires (Thousands of Lb.)
Actual Tension in Guy (Thousands of Lb.)

Fig. 3—Translating line tensions to guy tensions

Lighting Revolutionized by Science of Seeing

By MATTHEW LUCKIESH

Director Lighting Research Laboratory,
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No longer are problems in the production and control of light the major tasks of the illuminating engineer. He has gained sufficient if not perfect domination of them.

Today's objective becomes the specification of lighting which will meet the complicated interrelationships of physiological and psychological factors.

Recognition of the new approach was voiced by Dr. Luckiesh some time ago. How to accomplish it is the subject of this discussion.

ARTIFICIAL lighting is a chain of three links—production, control and specification of light. For many years a science of light production has been evolving and serving well. With every advance in the production of light, opportunities for applying the science of optics increased. As a result a science of light control evolved along with the science of light production.

The third link in the chain has long been weak; in fact, for the most part it has been a makeshift. It is the most important part of lighting because it is the one which directly affects every civilized human being who can see. Indeed, *seeing* is the magic key which unlocked the door to a new science of lighting specification. Light has always been produced and purchased as an essential to seeing. Therefore, the development of a science of seeing would also yield a science of lighting specification.

For many years a science of vision has been evolving, and apparently this was erroneously assumed to include seeing[1]. Now it is obvious that it does not. Seeing includes vision as a tool; also lighting as a tool. But seeing includes much more. Involving human beings as it does, it is much more than a physical science. It is a complexity involving physiological and psychological sciences. Its very complexity militated against a rapid development of a science of seeing, and, therefore, of lighting specification. Also, the psychophysiological realm is much more difficult to invade than the physical realms of production and control of light and of eyes.

A science of seeing evolves

Lighting, being essential to seeing and being universally controllable, could not be understood without adequate knowledge of seeing. Therefore, the evolution of a science of seeing was a natural product of scientific researches in lighting. In fact, this new science is the direct product of about two decades of continuous, tedious and extensive research. Actually, the ultimate objective was not seen clearly until a decade ago. By no means is the science of seeing, or the science of lighting specification born of it, complete. It is almost as complex as living. But already it has revealed a multitude of new facts, many radically new ideas, and new viewpoints. Already it has raised lighting from insignificance to prominence. Already it reveals new and effective approaches in the development of lighting.

The sciences of light production and control have yielded valuable sources and devices. But the new science of seeing, in supplying a scientific foundation for lighting specification, is the most important contribution which has come to lighting. It enormously strengthens the third link in the chain—and a chain is only as strong as the weakest link. Lighting can now be transformed from an empirical art, with all the hesitancy and lack of confidence which empiricism entails, into a sound science with all the aggressiveness and confidence which sound knowledge supplies.

In the paragraphs which follow some of the major new facts, ideas and viewpoints are briefly discussed. They reveal new approaches which are really effective. To lighting interests and to the consumers, the new science of seeing reveals the need for using many times more light and for the introduction of lighting as well as of foot-candles. Up to the present this is the most far-reaching revolution in lighting development. Indeed, no such fundamental revolution can be possible even in the future.

Efficiency of seeing is ratio of useful effort to total effort

Human Beings Are Human Seeing Machines—Seeing is the most important and universal controllable activity of human beings operating as human seeing machines. This new conception greatly extended the viewpoint of seeing and of lighting. As a machine, a human being is entitled to know the cost of seeing to him and he has a right to reduce that cost as much as possible. His efficiency as a seeing machine is not measured by the useful work he does per hour or per dollar. His efficiency should be measured, or at least considered, as the efficiency of other machines are. It is the ratio of the useful work done to the total work done. Immediately it becomes necessary to learn how much useless internal work is involved in the process of seeing.

[1] *Seeing—A Partnership of Lighting and Vision, by M. Luckiesh and Frank K. Moss, Williams & Wilkins Company, Baltimore, 1931.*

New fields of research, and the need of new methods and technique, were revealed by this new viewpoint. To be able to see ceased to be all important. How easily does one see—perform this or that visual task—immediately became far more important than merely being able to see. This new realm has been successfully invaded. For example, it has been found that reading black print on white paper, which actually can be done under a fraction of a foot-candle, becomes easier and easier as the intensity of illumination is increased to at least 100 foot-candles. In fact, the results indicate that this task continues to become easier up to the neighborhood of 1,000 foot-candles—the intensity of illumination outdoors in the shade.

This was the first time in man's entire history of seeing that such an experiment was performed. In this respect the research is epochal. Furthermore, it gave the first scientific support to the logical expectation that human eyes and human seeing machines were designed for natural lighting outdoors.

To meet the penalties of civilization

Man Greatly Altered Nature's Plan—Civilization is developed in ignorance as well as with intelligence. Increased burdens go hand in hand with increased convenience and comfort. Artificial conditions are substituted for natural ones without full knowledge of the consequences. Civilization has imposed upon eyes and human seeing machines unnaturally severe, prolonged and critical visual tasks under greatly restricted light and altered lighting. Hours of close work are now the rule, although eyes and human beings evolved under an abundance of natural light outdoors when close visual work was casual. Convergence of eyes requires effort and so does concentration of attention. The ideal distance for seeing is at a distance of 15 ft. or more. This page is read within arm's length because it is convenient to do so.

Modern science serves both as a vanguard and rearguard. It builds civilization and it remodels it. The science of seeing is an outstanding rearguard service. Man came indoors and imposed new tasks and new environments. In fact, the tasks were abnormal and the lighting was subnormal. It was obvious to man that he needed light, but unobvious penalties remained hidden. Only modern scientific method reveals the unobvious. The science of seeing has already revealed hidden penalties, of which we are not conscious, and the new science of lighting can diminish them. One cannot see an electron or an electronic current, but one does not doubt their existence for this reason. Similarly, poor conditions for seeing exact hidden costs and penalties. Human resources are unduly wasted. Modern science is proving this just as it proves the existence of other hidden and unobvious matters. It is proving the costs in damaged eyes, unnecessary fatigue, undue nervous and muscular tension. Eyes should develop properly, as arms and legs do, with proper use. But a great percentage become defective.

Promoting Lighting From a Minor to a Major Rôle—A human seeing machine, as such, is interested in three things: (1) The visual task, (2) the eyes or, more broadly, the visual sense, and (3) the lighting. When the controllability of these three is carefully studied lighting becomes of greatest importance, instead of remaining incidental in seeing, as it is commonly considered.

The visual task is sometimes controllable by some one. For example, printers can use larger type. Some visual tasks, such as assembly and inspection, can be improved by better backgrounds. But, in general, visual tasks must be accepted more or less as they are. The eyes may be "sharpened" by means of proper glasses, if they are defective—and most of them eventually are. Beyond this, no control can be exercised over this factor.

Light and lighting are always essential. They are universally controllable by some one. Most persons can do something about the lighting in most of the seeing that they are obliged to do. Thus light, instead of remaining incidental, as heretofore, becomes highly important and, in most cases, all important. Its controllability wins for it the major rôle.

The End Product Is Human Welfare—Seeing goes hand in hand with living nearly all the time. It is nearly as complex as living, but it can be divided into at least three parts. These are: (1) The external physical world of things to be seen; (2) the eyes as tools and also as doorways to the consciousness through the visual sense, and (3) the internal realm of psychological and physiological effects of seeing upon the human seeing machine. This is the complex chain leading from the visual task to the end product of human welfare, which includes human efficiency and behavior. Viewing seeing in this manner, one cannot escape the conclusion that lighting can be very important.

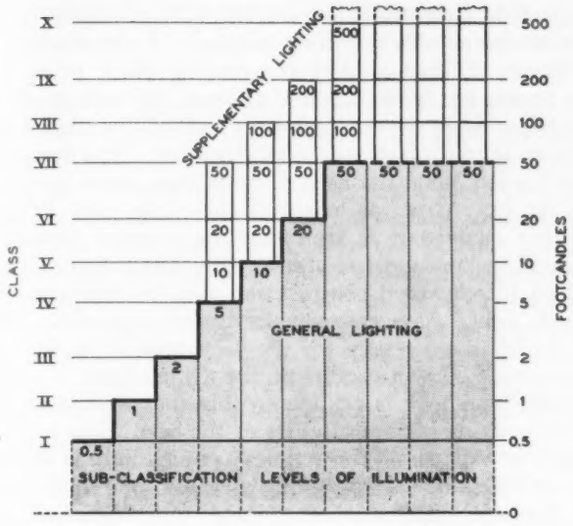
The visual task in the external realm may be a traffic sign, a task in the work world, recreational reading, or sewing at home.

> **The science of seeing includes knowledge of the relationships of such fundamental factors as size of object, brightness, contrast and time available or necessary for seeing the object. But more than this, it must know the influence of controllable and uncontrollable factors on the speed, certainty and ease of seeing.**

Lighting plays an important rôle in *all* cases. The eyes are both tools and doorways of impressions which play a rôle in the internal realm of psychophysiological effects.

The science of seeing has invaded this heretofore unexplored realm, where much of the cost of seeing has been hidden. The end product of this complexity from the external to the internal realm is human welfare. It involves safety, efficiency, productiveness, health and behavior of human seeing machines. Lighting is overwhelmingly the most important factor from the viewpoint of willfully improving seeing and, therefore, human welfare.

Visibility Measurements Were Misleading—Science consists of measurements and correlations of these. Without measurements little is known about anything. As long as lighting and vision were studied merely as tools, the new concept of seeing as a human activity was not developed. Studies purporting to deal with seeing really dealt with the limitations and abilities of the eyes as tools. For example, measurements of visibility revealed nothing more than threshold or minimum conditions. Notwithstanding the fact that the conditions for seeing indoors are generally very poor, even in the daytime, human seeing machines are seldom obliged to



"General lighting plus"

is the term the author has applied to a combination of general lighting upon which supplementary localized lighting has been superposed. This diagram is based upon new knowledge of the foot-candle scale of effectiveness and shows how to obtain adequate light economically and proper lighting scientifically.

operate under threshold or near minimum conditions for seeing. Obviously, such knowledge as yielded by threshold measurements of visibility alone are of little practical value. Still, this was about all the knowledge available before the recent development of a science of seeing. The latter aims to establish optimum conditions.

Already it has revealed enormous ranges between desirable optimum conditions and the minimum conditions under which seeing can be done. For example, for reading black print on white paper it is now indicated that, for maximum ease of seeing, the intensity of illumination should be at least 10,000 times greater than the minimum necessary for seeing. In other words, one may read a newspaper under 0.1 foot-candle, but can read it most easily under an intensity of illumination of the order of 1,000 foot-candles. One enjoys reading near a window where the intensity is commonly 200 foot-candles or outdoors on a porch where the intensity is still greater. Unfortunately, one is unable to judge ease of seeing. As the conditions approach the threshold, one is conscious of strain, nervous tension and general difficulty. Obviously, the difficulty must decrease as the conditions are improved. The science of seeing already has revealed that ease of seeing actually increases. The measurement of ease of seeing is a tedious and complex matter involving also the integration of the effect over long periods. Fortunately, there appears to be a correlation between ease of seeing and threshold visibility. Therefore, simple visibility indicators[2] promise to be valuable in determining optimum foot-candles by actually measuring minimum foot-candles necessary for barely seeing.

A New Concept of Visibility—It has been shown that visibility measurements of the past only revealed the limitations or abilities of the eyes as tools. When this narrow interest in eyes gives way to the broad viewpoint of human beings operating as seeing machines it has been seen that ease of seeing becomes of greatest practical interest. But a new concept of visibility is also born.

Let us take the case of a driver of an automobile approaching an intersection. The driver is more than a seeing machine, but regardless of his various tasks he has a given total sense capacity. A part of his sense capacity is utilized in driving the automobile, even though he does this automatically. Useless noises are distracting because they also usurp some of this capacity. The driver also listens for telltale noises which may warn him of street cars or other vehicles approaching the intersection. In many ways his so-called sense capacity is more or less utilized. His efficiency as a seeing machine is greatly reduced. Such reductions have been proved by the science of seeing.

Suppose he passes a painted traffic "stop" sign without seeing it. An officer stops him and points at the sign. Of course, it is now easily visible, because the driver knows it is there and he has nothing else to do but see it. However, when he was driving his efficiency as a seeing machine was much less.

Here again light is the most practical means of providing the factor of safety necessary to make the sign visible to a seeing machine whose efficiency is lowered by other simultaneous tasks. Many traffic signs which are not self-luminous are shown to be worthless by the new science of seeing. A bright self-luminous sign is highly visible compared with a painted one.

Thus, through the new concept of seeing and human seeing machines a new and proper concept of visibility arises. This new principle has countless applications throughout many civilized activities. And always light and lighting can come to the rescue, impelled by confidence which knowledge alone inspires.

Foot-candle a variable value

Foot-candles Acquire New Meaning—The new science of seeing has altered old ideas of foot-candles and has crystallized some vague ones. The foot-candle is a physical unit, or at least has been considered as if it were. Actually, a foot-candle is valuable to human seeing machines only in proportion to the aid it renders in seeing. Foot-candles, as physical units, can be added arithmetically because they are constant in value. However, from the viewpoint of seeing, a foot-candle is no longer of constant value. One foot-candle when added to one foot-candle is a real aid to seeing. But when one foot-candle is added to 10 or to 100 foot-candles it is relatively insignificant. Of course, this has been known, but the predominance of the physical sciences and the absence of a science of seeing have prevented a full recognition of this in lighting practice. It is now well established that foot-candle scales should be geometric and that the intensity of illumination must be doubled if a significantly noticeable improvement in seeing is to be achieved.

In brief, the new science of seeing reveals important inconsistencies and many ridiculous foot-candle recommendations in the past empirical era of lighting practice. The old codes of lighting, in which foot-candle recommendations were refined far beyond knowledge, not only then but now, must be abandoned. No better suggestion has appeared than to establish about ten steps in foot-candles from 0.5 to 500 foot-candles, arranged approximately in geometric ratio using round numbers, such as 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500. In the lowest class

[2] *The Applied Science of Seeing, by M. Luckiesh and Frank K. Moss, Transactions I.E.S., 28 (1933), 842.*

the lighting of country highways and railroad yards might be placed for the present. And, for the present, sewing on dark goods and fine lacemaking would be placed in the top class. These recommendations are by no means adequate from an idealistic viewpoint, but they represent a great advance over the present one-foot-candle age.

How much light for what?

Humanitarian Foot-candles—The ideal intensities of illumination for much of the modern work of the human seeing machine could scarcely be obtained with present light sources, even if the cost of lighting were not considered. However, enormous advances are possible without undue cost if the proper system of lighting is used.

The following foot-candle recommendations are ultra-conservative from the viewpoint of the new science of seeing, provided that, for the higher intensities, the proper system of lighting is used. This is a system of *general lighting plus* which provides general lighting plus properly directed supplementary lighting. These recommendations, even though conservative, represent a great advance which would reduce much unnecessary waste of human resources due to really primitive or unnecessarily poor conditions for seeing which are prevalent throughout the indoor world in the daytime and everywhere at night.

100 Foot-candles or More—For very severe and prolonged tasks, such as fine needlework, fine engraving, fine penwork, fine assembly, sewing on dark goods and discrimination of fine details of low contrast, as in inspection.

50 to 100 Foot-candles—For severe and prolonged tasks, such as proofreading, drafting, difficult reading, watch repairing, fine machine work, average sewing and other needlework.

20 to 50 Foot-candles—For moderately critical and prolonged tasks, such as clerical work, ordinary reading, common bench-work and average sewing and other needlework on light goods.

10 to 20 Foot-candles—For moderate and prolonged tasks of office and factory and, when not prolonged, ordinary reading and sewing on light goods.

5 to 10 Foot-candles—For visually controlled work in which seeing is important, but more or less interrupted or casual and does not involve discrimination of fine details or low contrasts.

0 to 5 Foot-candles—The danger zone for severe visual tasks, and for quick and certain seeing. Satisfactory for perceiving larger objects and for casual seeing.

How Difficult Is a Visual Task?—With ease of seeing displacing the old idea of merely being able to see, it becomes necessary to inquire into the difficulty of various visual tasks. Through a correlation between ease of seeing and threshold visibility, which has been roughly established by the science of seeing, the relative difficulty of visual tasks may now be stated in terms of a controllable factor, such as foot-candles. Of course, every one knows that such tasks as fine engraving and sewing on dark goods are "harder on the eyes" than ordinary reading, but no attention was given to the greater cost to the human seeing machine. In empirical lighting recommendations somewhat more light was allowed for tasks obviously more difficult than others. But this extra allowance has been small and is now known to be ridiculously insignificant.

In considering the difficulty of visual tasks, it is necessary to begin with a consideration of such factors as size of critical details, contrast and brightness. Size has been given some consideration for years, because it is such an obvious factor when near the limit of visibility. However, the new science of seeing has revealed contrast as a more generally important factor. Still, it has been grossly neglected. Brightness is the result of foot-candles and reflection factor of a reflecting surface. If, for example, one desires 20 foot-candles for reading black print on white paper, he should demand at least 200 foot-candles if the paper were dyed a dark gray[3] which reflects about one-tenth as much light as the white paper. This demand is based solely upon the need for ten times more light to make the gray paper as bright as the white one. When the paper is dyed it is seen that the contrast between print and background has been greatly diminished. The effect of this lowered contrast can also be counteracted by more light. As a consequence, much more than 200 foot-candles is necessary for the same ease of seeing as in the case of 20 foot-candles on the white paper.

A telephone book is printed on thin inexpensive paper and the printing is naturally not of the best. This is true of many newspapers. Three times as much light is necessary for the same ease of seeing as would be required to read the same matter when printed with black ink on good book-paper.

If 20 foot-candles is recommended for the clerical office of a garment factory, on the basis of reflection factor alone, about 200 foot-candles should be recommended for hand sewing on average dark goods in the factory. Actually, a consideration of all the major factors in sewing indicates that more than 10,000 foot-candles would be required for approximately the same ease of seeing as in the case of clerical work in the office! Certainly when the science of seeing invades the field of difficulty of visual tasks foot-candle requirements become unbelievably high.

Too often lighting is judged by reading print on white paper. In the first place, studies of seeing reveal human seeing machines as very poor seeing meters. In the second place, important factors, such as contrast, have not been taken into account because data pertaining to them have not been available until recently. Most visual tasks, with the exception of reading, involve relatively low contrasts, and many of them are very low. They require foot-candle intensities far greater than have been considered even in the dreams of the lighting specialist.

Too much light cannot be obtained in most cases of lowered contrast, provided the lighting is properly done. Thus the science of seeing shows that the practical limit is ingenuity in lighting and a new economics based on new knowledge of the human seeing machine and the cost of seeing to human beings.

In considering the difficulty of visual tasks, the eyesight of specific individuals should be taken into account. Defective eyes are generally aided more by light than normal eyes. The pupil of the eye decreases in size with age. Older workmen, who through experience do the finer machine or bench work, need more light than a young person. At 60 years of age the pupil admits less than half as much light as it does at 30 years of age. Considering that old eyes have also been dulled by use and abuse, it is safe to assume that persons past 50 or 60 years should have several times more light than at 20 or 30 years.

Incidentally, by increasing the intensity of illumination from 1 to 100 foot-candles the minimum size of type

[3] *Light and Work, by M. Luckiesh, D. Van Nostrand Company, New York, 1924.*

which is just visible is reduced about as much as it is by the correction of moderate eye defects by means of glasses.

Lighting Is More Than Foot-candles—Lighting involves three factors: (1) Quantity of light or foot-candles; (2) quality of light or spectral character, and (3) quality of lighting. Foot-candles are given primary consideration in the science of seeing because intensity of illumination is an ever-present factor and because present intensities are woefully low. Quality of light may become an important factor after quantity of light has become generally adequate. For the present it is a secondary factor excepting in special cases. However, quality of lighting is always a factor. It involves the distribution of light and eventually of brightness. Distribution may include diffusing, shading and directing of light.

Lighting in three dimensions

Strictly considered, lighting is not practiced when only light—foot-candles—is supplied on a horizontal plane. In some cases where the object to be seen is two-dimensional, as in reading, merely supplying foot-candles may be sufficient. However, in general, the system of *general lighting plus*[4] is satisfactory. Until properly directed supplementary light is supplied lighting has not been accomplished. With directed light the work can be lighted properly, indifferently or poorly. Three-dimensional objects are revealed by lighting as well as by foot-candles. Highlights and shadows play important parts in seeing such objects. Furthermore, localized light aids materially in concentrating attention. The proof of this is to be found by any one in his own experiences in his home. With some general light in the room the most satisfactory place to read is near a portable lamp.

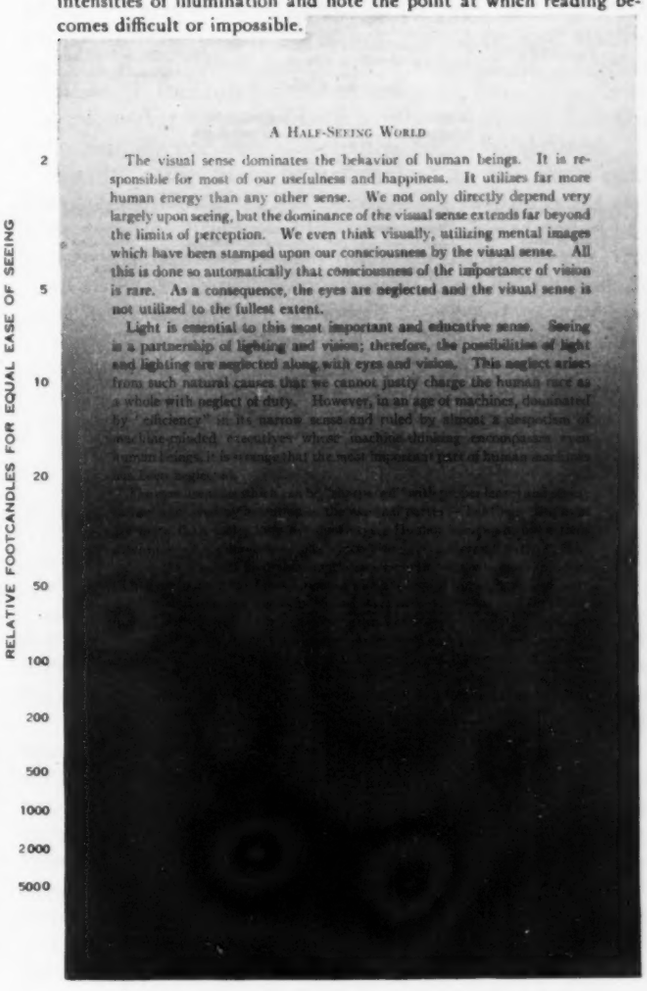
Not only is *general lighting plus* the best system in general for seeing and for concentrating the attention upon the task, but it offers a practical way to obtain high intensities of illumination demanded by the science of seeing. It is easy for a benchworker to have 100 foot-candles on his work. It is practicable to obtain 500 foot-candles. The present writer reads at home under 100 to 200 foot-candles, writes under 100 foot-candles and obtains 100 foot-candles on his office desk from a ceiling fixture designed to provide *general lighting plus direct light.*

The general lighting must be increased as the direct lighting is increased. No fixed ratio is available, but the science of seeing includes already a good deal of data upon which to base a rule. It appears to be safe to have the general light 10 per cent of the total light on the task. In most cases this percentage could be somewhat smaller. Of course, brightness is the final factor and, if the surroundings are of high reflection factor, the general-lighting component can be reduced. For example, if a desk or bench is against a wall and the worker faces the wall great control is possible by painting the wall white or light gray.

Thus it is seen that the science of seeing reveals the need for high intensities of illumination. It also shows how to obtain them economically by a system which should be in general use. Only by this system can lighting in its proper and complete sense best serve human seeing machines.

[4] *General Lighting Plus, by M. Luckiesh, Transactions I.E.S., 24 (1929), 233.*

Visibility increases as the intensity of illumination increases. So does ease of seeing. Read the printed matter below under different intensities of illumination and note the point at which reading becomes difficult or impossible.

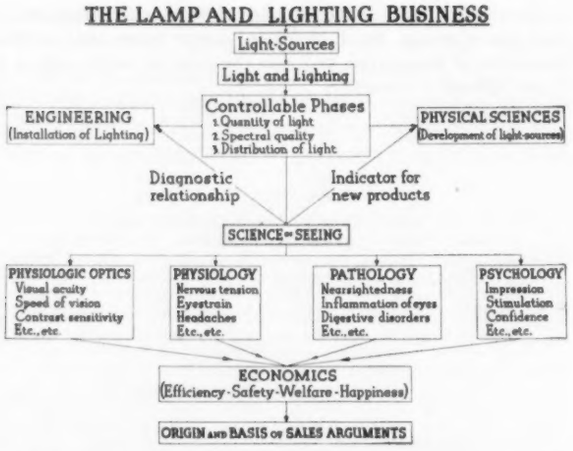

RELATIVE FOOTCANDLES FOR EQUAL EASE OF SEEING
1
2
5
10
20
50
100
200
500
1000
2000
5000
A HALF-SEEING WORLD
The visual sense dominates the behavior of human beings. It is responsible for most of our usefulness and happiness. It utilizes far more human energy than any other sense. We not only directly depend very largely upon seeing, but the dominance of the visual sense extends far beyond the limits of perception. We even think visually, utilizing mental images which have been stamped upon our consciousness by the visual sense. All this is done so automatically that consciousness of the importance of vision is rare. As a consequence, the eyes are neglected and the visual sense is not utilized to the fullest extent.
Light is essential to this most important and educative sense. Seeing is a partnership of lighting and vision; therefore, the possibilities of light and lighting are neglected along with eyes and vision. This neglect arises from such natural causes that we cannot justly charge the human race as a whole with neglect of duty. However, in an age of machines, dominated by "efficiency" in its narrow sense and ruled by almost a despotism of machine-minded executives whose machine-thinking encompasses even human beings, it is strange that the most important part of human machines

Lighting for seeing requires new tools

This illustrates a "visibility indicator" in simple form developed by M. Luckiesh and Frank K. Moss. The original is calibrated in relative foot-candles for threshold visibility and for approximate ease of seeing.

Shortcomings of Production Tests—The production of a worker is important both to the employee and to the employer. But it has gross shortcomings as a means of appraising lighting for human seeing machines. Involved in two decades of research which have created the new science of seeing are many researches which involved a production test in some way. At best, production usually ceases to increase materially after 20 foot-candles has been supplied. Often this optimum is reached at 10 foot-candles. With the development of the idea of the human seeing machine other tests were run and the old ones were viewed from a new viewpoint. Now it is obvious that more light and better lighting continue to benefit the human seeing machine long after the conditions for maximum production have been reached. In other words, much more light is necessary for maximum ease of seeing than for maximum speed of working. Other factors besides seeing set the limit on production.

Some simple examples suffice for illustration. A magazine placed on a vibrating rack to simulate reading on a train could be read practically as rapidly as when



That light is made and sold for the purpose of seeing is incontestable

The new science of seeing is more than a necessary foundation for a science of utilization. Eventually, it should be the heart of the lighting business, extending influence to the development of light sources and lighting equipment as well as to lighting specifications.

the rack was stationary. Still, when vibrating, the task was obviously very severe on the readers. Their eyes became inflamed and they became very nervous toward the end of the period reading the vibrating matter.

A large group of workers was required to perform a certain task, involving seeing and production, at the beginning and end of the regular day's work. At the end of the day measurements indicated that their eyes were dulled and tired and obviously the subjects were tired from their regular work. Still, they performed the task somewhat more accurately and rapidly at the end of the day and also were more attentive to it.

Production tests are not reliable in appraising seeing conditions and they generally fail entirely at intensities of illumination now known to be very low for the welfare of human seeing machines.

Eye Specialists Become Allies—The science of seeing has shown the eye specialist that by correcting defective eyes with glasses or by treating them in other ways he is dealing with effects and not generally with causes. This is the age of prevention as well as cure and eye specialists are taking an interest in lighting through this new doorway of seeing. It now becomes obvious to them that they have been dealing with eyes and vision which are merely tools. Similarly, the lighting specialist dealt with light and lighting as tools. Neither has been concerned with seeing as an activity of human beings operating as human seeing machines. The science of seeing has opened the door for seeing specialists to enter. Already this new specialist is in the making. He may evolve from the eye specialist or lighting specialist.

In this country there are 35,000 oculists and optometrists. This formidable army is recruiting already. The lighting interests will do well to help them to be helpful in lighting development. The present army of lighting specialists is a corporal's guard by comparison.

At Last!—A Lighting Consciousness—Experiences with the new science of seeing already guarantee that this new and ultimate approach to lighting awakens a lighting consciousness. When the story of lighting and seeing is properly told it arouses an intense interest. Lighting at last enters the class of labor-saving devices. Certainly there is universal appeal in labor saving. Seeing is revealed as a universal and important activity of human beings operating as human seeing machines. Ease of seeing eclipses mere seeing in importance. Hidden penalties of seeing are revealed as unnecessary wastes of human resources. And every new fact and new vista revealed by the science of seeing gives lighting an important rôle. In fact, lighting becomes of major importance wherever seeing is involved, because it is universally necessary and universally controllable.

The science of seeing gives birth to a science of lighting specification. Thus an empirical art of lighting, which has already served humanity greatly, becomes a lighting science. As such, it will serve almost infinitely more. Lighting specialists and commercial interests are beginning to have an inkling of the new possibilities. However, only one who has lived for two decades with the science of seeing and is familiar with every detail of its growth can say that lighting for this half-seeing world has just begun. And there will be legitimate rewards for every one. More light and better lighting require more and bigger lamps, more and better lighting equipment, more and better wiring and a lighting load multiplied eventually many-fold.

Electric Hotbeds Speed Plant Sprouting Cheaply

Temperatures between 80 and 90 deg. F. are the most desirable for starting sweet potato plants, according to results secured in electric hotbeds with an average energy consumption of 1.58 kw.-hr. per square yard per day at Oklahoma Agricultural and Mechanical College by R. A. McGinty, head of the horticultural department, and Earl R. Miller, research assistant in rural electrification.

Preliminary experiments conducted in the greenhouse with four beds held at temperatures of 60, 65, 75 and 85 deg. F. gave results highly in favor of the 85 deg. bed both in the number of plants produced and the rapidity of growth (ELECTRICAL WORLD, page 554, April 29, 1933). The energy consumption required where the house temperature averaged 65 deg. F. was 3.14 kw.-hr. per day per square yard of bed for the 85 deg. bed and 1.64 kw.-hr. per day per square yard for the 75 deg. bed.

On March 24 potatoes were bedded outside in four 6x6-ft. soil-banked, glass sash-topped hotbeds. All beds were filled with half sand and half soil and rows of various size and treated potatoes were run through both kinds of soil for comparison. Three beds were each provided with a 60-ft. length of hotbed cable in the soil with thermostat control, the thermostats set at 75, 85 and 95 deg. F. respectively. The fourth bed was a check bed without heat.

The results again showed that the 85 deg. bed gave the highest number of plants per pound of seed, gave better plants than the other beds, and in the same time that the 95 deg. bed required for four pullings with more energy. The 85 deg. bed required 1.58 kw.-hr. per square yard of bed with outside temperature averaging 67 deg. for the duration of the run. Heating at 85 deg. reduced

the time for plants to come up from 22 to eight days and from 81 to 46 days for four pullings, in comparison with the check bed.

The soil produced slightly earlier and 24 per cent more plants than the sand. The plants produced in the sand, however, had the better root system. A comparison of results with treated and untreated tubers indicates that where bed temperature is held around 85 deg. F. the potatoes should not be soaked, and that where medium and large tubers are used it is desirable to split them before bedding as this will produce earlier, more uniform and a larger number of plants.

LETTERS TO THE EDITOR

Sleeve or Anti-Friction Bearings

To the Editor of the ELECTRICAL WORLD:

I am prompted to write you in connection with an article appearing in the December 9 issue of ELECTRICAL WORLD on page 760 entitled "Benefits Derived from Anti-Friction Bearings," written by F. A. Westbrook.

First, as indicative of our experience in building the first sleeve-bearing motors and more recently large quantities of anti-friction bearing motors, but having anti-friction experience going back over twenty years or more as a company, I am a little bit surprised at your tolerance in such sweeping assertions in favor of anti-friction bearings. Probably 80 to 90 per cent of our production at the present time is anti-friction bearing, but at the same time we recognize all of the problems and troubles with anti-friction-bearing mountings, maintenance, and particularly lubrication, problems so real that at the present date it is not at all an uncommon experience to have a good customer who has been using anti-friction-bearing motors exclusively change his specifications to prescribe the use of sleeve bearings instead.

One point that I take particular exception to is the statement that comparative tests of the two types of motors, namely, ball and sleeve bearing, indicated that in some cases starting current for ball-bearing motors was 50 per cent less than for plain or sleeve-bearing motors. In the light of our experience I can only brand this statement as misleading, to say the least. Such a change in starting current, irrespective of mechanical construction, could only be accounted for in the design characteristics of the motor itself, and could not represent consecutive tests of the same motor first with ball bearings and then with sleeve bearings. In so far as the motor only is concerned, we have never been able to detect any difference in the starting currents of the two types, since in so far as the maximum current indicated in starting is concerned, this is a function of the constants of the machine and in nowise dependent on the mechanical costruction. Then the minimum starting current which can be indicated on a motor running light, and regardless of the friction, depends, of course, on the speed with which it accelerates and the damping of the meter used to indicate this current. As a rule this amounts to about 75 per cent of the full locked rotor current, so assuming that the friction in a sleeve bearing was sufficient actually to lock the rotor against rotation with full torque applied, the maximum difference for which I could account would be 25 per cent, representing the difference between instantaneous peak of starting current and the full locked rotor value which might be attained if the rotor were actually stalled. The latter case, however is so unlikely that I would not feel that even this 25 per cent differential could be secured.

By the same token the statement in the same paragraph that the use of ball bearings on motors made possible the use of motors of one-third lower rating for stoker installations is also quite misleading. The friction losses in electric motors, even with the poorest design, have never been sufficient to permit of any such change. The elimination of sleeve bearings in the stoker itself as well as in the motor might, of course, account for such a reduction, but this is not my interpretation of the statement in the article.

The last statement in this paragraph, namely, that the decreased fricion losses mean lower no-load losses and also less temperature rise is entirely correct, but friction losses in the average machine do not exceed 20 to 25 per cent of the total losses, so that assuming they could be eliminated entirely, it would not affect the over-all performance nearly to the extent that the trade is often led to believe.

The final misstatement, in my opinion, is the last sentence in the next paragraph, wherein it is stated that all of these difficulties have been completely overcome by the use of ball-bearing motors.

I have just checked with our service manager and can say it is his opinion that the percentage of our total trouble cases represented by bearings are just as great with the use of the anti-friction bearings as they were with the use of sleeve bearings.

We are heartily in favor of the application of anti-friction bearings in electric motors, but are very loath to see them offered as a panacea for all ills, since that is misleading to the trade.

F. E. HARRELL,
Assistant Chief Engineer.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

St. George Breakdown Was a Boiler Failure

To the Editor of the ELECTRICAL WORLD:

Your article referring to the recent breakdown at the St. George Hotel was incorrect in one particular (ELECTRICAL WORLD, January 27, page 165). The fact is that the shut-down was caused by a failure of one of our boiler tubes, which happens once in a great while, and as a rule our plant is not affected thereby. In this instance, however, it happened when our plant was carrying a peak load, and the reserve boiler, which happened to be directly opposite the boiler where the breakdown occurred, could not be fired promptly, due to the great amount of live steam escaping in that area. However, it took a little more than an hour to get things going again. I must honestly say that we have had no breakdown on any of our steam engines or generators during the last five years.

CARL LETSCH,
Manager.
St. George Hotel,
Brooklyn, N. Y.

THIS WEEK'S NEWS

E.E.I. Code Action Halts

ELECTRIC light and power code negotiations reached a deadlock this week, primarily on the subject of hours of labor, but secondarily on the demand of the industry that a special clause reserving all its "constitutional rights" be inserted in the code. As a result little progress has been made beyond the point reached at the public hearing several weeks ago. (ELECTRICAL WORLD, January 20, page 126.) Donald Richberg, NRA counsel, denies that the status of municipal plants is blocking signing of the code.

NRA is fighting against the inclusion of longer hours than 40 a week in this or any other code, while the industry code committee has presented extended arguments in favor of longer hours in smaller communities, especially those where longer hours are common and where local citizens are the chief stockholders and oppose a partially idle class of utility employees as a method of taking dividend money by unjustifiably increasing costs. The proposal has been made to put in a basic 40-hour week and to make provision at the same time for exceptions in the case of small communities where, for instance, there are only two men on a shift. Whether this will be acceptable to NRA or to the industry is an open question.

"What's a constitution between friends?"

References to "constitutionality" in the code provisions, while touching in part on the power the industry seeks for the code over municipal plants, is a little different from that. It has reference primarily to the proposed inclusion of the clause holding to the constitutional rights of members of the industry and looks to forestalling future difficulties from code enforcement and from state legislation which might conceivably follow the adoption of the code.

There is not a little feeling, Washington corridors echo, that the electric power industry may delay action, taking the risk of an imposed code, especially as no code has yet been imposed on any industry, although NIRA gives the President the express right to do so.

Richberg's view of delay

Inclusion of municipally and state-owned power and light companies in the power industry code is not a problem in the conferences looking to completion of an agreement for the industry, as an agreement has been reached whereby no reference will be made in the code to publicly owned units, according to Donald Richberg, NRA legal counsel. The chief problems blocking signing of the power code are labor questions and provisions concerning the selling of merchandise by power companies.

Power Survey Progresses

With the appointment this week of a committee consisting of the Secretaries of War, Agriculture, Commerce and the Interior to make preliminary studies of the proposed permanent national program of water resources development (ELECTRICAL WORLD, August 26, 1933, page 259) another Roosevelt plan approaches reality.

Lac Noir Plant Damaged as Pipe Line Fails

According to unofficial reports, a defective connecting angle of a manhole in the distributing piping at the 120,000-kw. Lac Noir plant of the Société de l'Energie Electrique du Rhin (ELECTRICAL WORLD, January 28, 1933, page 121) has been the cause of the partial destruction of the station with a loss of nine lives. Faulty material of the connecting angle burst owing to fatigue under static pressure, according to engineers of the Escher Wyss Engineering Works, Ltd., Zurich, who erected the pipe line but did not furnish the pipe.

The Lac Noir plant is part of the Lac Noir-Lac Blanc hydraulic storage plan in the Vosges Mountains to supply the Rhineland and was to develop, when all four units were completed, a maximum of 120,000 kw. At night power from the Kembs plant of the company drives the units (motor-generator, pump and Francis turbine on one shaft) to pump water back through the same pipe line used to generate and thus restore the level of Lac Blanc. Two units were placed in operation in November and one was pumping at 8,000 kw. rate at the time of failure.

Senate Committee Approves Norris Rate Inquiry

Senator Norris of Nebraska has succeeded in obtaining from the Senate interstate commerce committee a favorable report on his resolution authorizing the Federal Power Commission to investigate rates charged for electric energy to residential, rural, commercial and industrial consumers throughout the United States. The resolution directs the power commission to utilize as far as is practicable information relating to electric rates and rate schedules filed with various state public service commissions. It empowers the commission to require corporations engaged in the sale of electricity to reveal their schedules of rates charged to all classes of consumers and to submit replies to specific questions set by the commission.

Senate Passes Bill to Curb Court Appeals

Designed to prohibit public utilities from petitioning federal district courts to enjoin rate orders of state public service commissions, the bill sponsored by Senator Hiram Johnson and reported by Senator George W. Norris for the Senate judiciary committee was passed last week by the Senate and is now pending before the judiciary committee of the House. The bill, which had been pending before the Senate for several years and which some Republicans had assailed as discriminatory and an invasion of private rights, was not backed by the administration, but Senator Johnson pointed out in debate that a similar measure had been approved by the President when he was Governor of New York.

While these measures [legislation setting up new principles for the regulation of industry] are in terms operative only during the present emergency, their influence must inevitably be projected into the indefinite future. What the ultimate effect will be upon our institutions, our traditional modes of thought, our philosophy of government—all these elements, tangible and intangible, that are embraced in what we call "the American system"—no one may now say.

GEORGE B. CORTELYOU,
President Consolidated Gas Company.

Addressing a group of employees in New York last week, Mr. Cortelyou stated that the public utilities are giving the fullest measure of co-operation to the national recovery program despite the fact that they have been singled out for oppressive and discriminatory taxation, for peculiar and burdensome impositions and for other grossly unfair treatment.

Senators Johnson and Norris contend its enactment to be necessary to prevent federal courts from blocking rate decisions of state regulatory bodies for "interminable periods." The bill would compel the utilities to act only in state courts, with the right to appeal the final decision to the United States Supreme Court. By thus eliminating an intermediary court, it is held that cases involving rates could be adjusted at once and eliminate the lengthy delay utilized by the utilities to nullify action by rate-making bodies which they opposed.

Diesel-Electric Train for 110 Miles per Hour

To experiment with high-speed lightweight train units the Union Pacific Railroad has just accepted the first fully streamlined train of practically entire duraluminum construction to have been built and has three similar units under construction for sleeper service. The train, powered by a 600-hp. Diesel-electric plant, is capable of a maximum speed of 110 m.p.h. with a cruising speed of 90 m.p.h. Built at Chicago by the Pullman Car & Manufacturing Company, which is also constructing the sleeper units, the entire weight of the train is virtually that of a single standard Pullman. It is designed to carry 116 passengers in two cars with the forward car containing the power plant, air-conditioning equipment, etc., and the mail and baggage space. Both passenger units are air conditioned from a central plant.

Lighting of the cars is indirect from a ceiling unit that runs the length of each passenger section and is also used as one duct of the air-conditioning plant which supplies air from overhead and exhausts it from under the seats on each side of the cars or the reverse, depending on conditioning duty cycle. The braking system has an electrical relay automatic mechanism supplemented by straight air control. Traction motors are located on each of the axles of the first truck only; the three other trucks are for trailer service.

McCulloch Defends Receivership

DEFENDING his own receivership of Middle West Utilities Company, which Samuel A. Ettelson is seeking to have voided on the ground of collusion between banks and Samuel Insull, Charles A. McCulloch testified before Judge Lindley in Chicago this week that he ousted Martin Insull as president of the company and denied him even a day's salary, despite Samuel Insull's plea that "Martin didn't have a dollar left," and that he also finally discharged Samuel Insull. Mr. McCulloch agreed with Mr. Ettelson's charge that under Insull the holding company was merely a brokerage house, going further when he averred it was a bucket-shop.

Under questioning, Mr. McCulloch admitted that Herman Walleck, vice-president of the Continental Illinois National Bank, had suggested him for the position of receiver. He denied there had been any collusion in his appointment and asserted that far from giving preference to the First National Bank, of which he is a director, he, as receiver of Middle West, had secured substantial concessions from the bank.

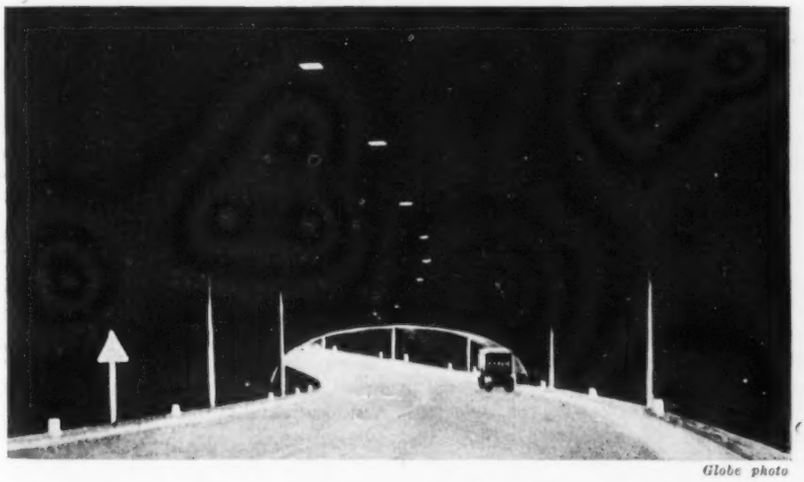
In April, 1932, the receiver said, Melvin Traylor, president of the First National Bank, told him about Marshall Sampsell's abstraction of 3,000 shares of Commonwealth and Central & Southwest Utilities stock from the Central Illinois Public Service Company, of which he was president, and of Martin Insull's abstraction of other stocks. Both abstractions were to cover private accounts of Sampsell and the Insulls, according to earlier testimony. The revelation forced the resignation of Mr. Sampsell and it was at this time that the witness refused to be lenient with Martin Insull, forcing him out also. Samuel Insull stayed on as receiver, the witness testified, until June, 1932, when, after learning of a defalcation which Samuel had ordered in the subsidiary Mississippi Valley Utilities Investment Company for Martin's benefit, Mr. McCulloch demanded Samuel Insull's resignation.

Nothing new in Greece

Mr. Insull's future plans are still unknown. His American passport expired this week and he made no move to seek an extension. He has technically lost his temporary residence in Greece, for his permit for his visit in that country, which expired January 31, was not renewed. Issuance of a warrant for the arrest of Martin Insull, requested by Damon C. Woods, American Consul in Toronto, was refused last week by Justice H. T. Kelly, who maintained that the United States authorities should be represented by an Ontario attorney in making such an application. In previous extradition proceedings against Insull Cook County, Illinois, was represented by Edward Bayly, who recently died. Martin Insull is at present free on bail of $20,000, pending a decision of the Ontario Appellate Court as to whether a judgment of Justice Charles Garrow, refusing to release him from custody, will be upheld.

Howard S. Duncan, who admitted embezzling $132,000 from the Northern Indiana Public Service Company, Hammond, Ind., electric and gas utility, is free after paying a $1 fine and costs in the case—a total of $19.75. The former assistant treasurer of the Insull company was sentenced also to two to fourteen years in the state penitentiary, but was paroled to the court bailiff.

FLOODLIGHTED HIGHWAYS NEXT?



Globe photo

High, approximately 33 ft., above the road surface, German engineers have suspended sodium-vapor lamps along the center of the new road between Cologne and Bonn. Cable-suspended at intervals of about 66 ft., an impression of glareless illumination and freedom from point sources is secured with this system. The economy of the sodium-vapor monochromatic source is fully capitalized upon in this installation.

Coming Meetings

Oklahoma Utilities Association—Tulsa, Okla., March 6-7. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

American Society for Testing Materials—Washington, D. C., March 7. C. L. Warwick, 1315 Spruce Street, Philadelphia, Pa.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 19-20. N. R. Beagle, 101 W. High St., Jefferson City, Mo.

Electrochemical Society — Asheville, N. C., April 26-28. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Northeastern District meeting, Worcester, Mass., May 16-18. Summer Convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

Edison Electric Institute—Atlantic City, N. J., June 4-7. B. F. Weadock, 420 Lexington Ave., New York.

Alabama Commission Seeks Holding Company Data

All utilities controlled wholly or in part by holding companies have been ordered by the Alabama Public Service Commission to file before March 1 full information regarding their relationship with the holding company. Holding companies known to the commission were also ordered to file the same data. Those not incorporated in Alabama were ordered to file the name and address of their state agent.

The order was issued under a legislative act of 1932 designed to give the state board closer supervision over holding companies where domestic companies were concerned. The commission is seeking to complete its utility data.

Would Oust Commissioner for Utility Defense

Cleveland City Council last week passed a resolution calling on Governor White to remove E. J. Hopple as chairman of the state utilities commission. Similar action has been taken by the Akron City Council and is the result of a speech made by Mr. Hopple recently in Cleveland (ELECTRICAL WORLD, February 3, page 201).

Robert C. Ryder, the member of the Council who made the motion that the commissioner be ousted, stated that "we must have on the commission men in whose fairness and impartiality we may have full confidence. It is impossible for consumers of Akron or any other municipality to retain confidence in a member of the commission who has prejudiced the acts of those seeking lower rates."

Unmoved by the protests, Governor White has taken no action toward the removal of the commissioner, contending that there is no ground for ousting him since "he merely was expressing a personal opinion." Mr. Hopple, a Cleveland attorney, was appointed to the commission by Governor White in 1930.

Oregon Utilities Halt Commission Budget Order

Temporary restraining order has been issued by the federal court in Portland, Ore., against the order of Charles M. Thomas, public utilities commissioner of the state, reducing salaries and disallowing management fees and certain donations proposed in the budgets of Northwestern Electric Company, Pacific Power & Light Company and Portland Gas & Coke Company (ELECTRICAL WORLD, February 3, page 199). By stipulation it has been ruled that hearing on the petition for temporary injunction will be held before a three-judge court. The commissioner's order protested by these three companies was issued early in January along with a number of similar orders affecting other companies operating in the state, striking out of operating budgets of these companies various items of proposed expense. The commissioner stated that he had no objection to the payment of these items out of surplus belonging to the stockholders, but he disallowed them in so far as they affected the rate of return of the companies for rate-making calculations.

One exception made

In a hearing relative to the operating expenses of Portland General Electric Company Mr. Thomas developed the testimony that administrative costs in this company were lower than those of any other large utility operating in Oregon. The commissioner's chief engineer, presenting comparative cost data between Portland General Electric Company and other large companies, stated that these low administrative costs were due to the fact the company paid no management or supervision fees to any holding or management company. The company is practically the only one operating in the state that has not received orders to reduce salaries.

New York Utilities Win Stay on Accounting Order

Petition by the Consolidated Gas Company and its affiliates for an extension of time to make effective the new uniform system of accounts which had been prescribed for utility companies in New York State (ELECTRICAL WORLD, January 27, page 165) has been granted by the Public Service Commission. The commission adopted the new accounting system last November and ordered that all companies put it into effect January 1 (ELECTRICAL WORLD, December 9, page 742). Under the present order the effective date has been extended to April 1, but any company desiring to do so may make the new system effective as of the first of any of the three preceding months.

In the petitions asking for an extension the companies contended that there was insufficient time between the date of the service of the order and the proposed effective date to put the system in operation. The postponement of the effective date is effective only provided the companies comply with certain requirements, including the preparation in time for including in the annual reports for 1934 of any analysis of all transactions between January 1, 1934, and the date that the new system is made effective, so as to include in the annual report for 1934 certain schedules based on the new accounting system.

Removal Hearing Set for Michigan Commission

Formal charges of "gross and habitual neglect of duty, misfeasance and malfeasance in office" and being "wholly unfit to execute the duties of their office" have been filed by Gerald K. O'Brien, Deputy Attorney-General of Michigan, chairman of a commission appointed to inquire into the work of the Public Utilities Commission (ELECTRICAL WORLD, February 3, page 198), against Kit F. Clardy, chairman; Harry C. McClure and Edward T. Fitzgerald, members of the commission. The report was submitted to Gov. William A. Comstock last week and the Governor immediately ordered the removal hearing set for this week.

Investigators found no basis for complaint against Commissioners Harold J. Maples and Robert H. Dunn. The resignations of these two members were in the hands of the Governor.

Familiar charges repeated

The investigation commission made several specific charges against the Public Utilities Commission, most of them having to do with delay in reporting on hearings in rate cases, including the Detroit Edison and Bell Telephone cases. Challenging the right of the Governor to preside at the removal hearing, Mr. Clardy, through two attorneys, demands that a disinterested circuit judge be appointed to take the testimony and make recommendations based on it. Mr. McClure has engaged an attorney to fight the removal proceedings. Clardy and Fitzgerald stated that the Governor had told them he was willing to give any member who would resign a clean bill and that he was determined to have a Democratic commission; that in removing the members he was doing away with the most cordially

disliked office holders in the state and his cause would be helped more than hurt.

Although Governor Comstock set the hearing for February 14, the Attorney-General indicated before then that removal proceedings would probably be delayed because of a ten-day notice which the law provides shall be given the members.

New Utility Bills Placed Before State Legislatures

Many additional public utility bills have been introduced for consideration by the various state legislatures now in session. A measure providing that the Massachusetts State Department of Public Utilities be given the control over operating companies that it had before the holding companies came into existence has been placed before the legislative power and light committee by Wycliffe C. Marshall. His petition provides that the Department of Public Utilities be given supervision over associations and trusts selling electricity or gas, raw materials or services to electric and gas companies under common ownership. Mr. Marshall claimed that holding companies have prevented reductions in the rates charged for these services.

Opposition to this bill and a bill filed by the Public Franchise League calling for virtual elimination of holding companies was shown by Sheldon E. Wardwell, representing the Massachusetts Gas & Electric Association, and B. Loring Young, representing the New England Power Association. Mr. Young said that the utilities department does not want such powers as are conferred by the Marshall bill and that ownership of stock makes no difference in rate making. He termed the Marshall bill as absolutely unnecessary and against public interest.

Would increase Ohio tax

Increase in the excise tax on electric, gas and telephone companies in Ohio from the present 2.35 to 5.35 per cent has been introduced in a bill in the Senate by Senator W. F. Haynes, who estimates that his measure will raise an additional six and one-half million dollars in revenue. He would exempt the first $100,000 of the gross receipts of every company from the 3 per cent increase. The first $100,000 of the gross receipts would still be subject to the present tax of 2.35 per cent, of which 1 per cent is a temporary levy for poor relief.

All public utilities would be required to file with the New York Public Service Commission at once schedules of reduced rates under the provisions of a bill introduced in the State Legislature last week.

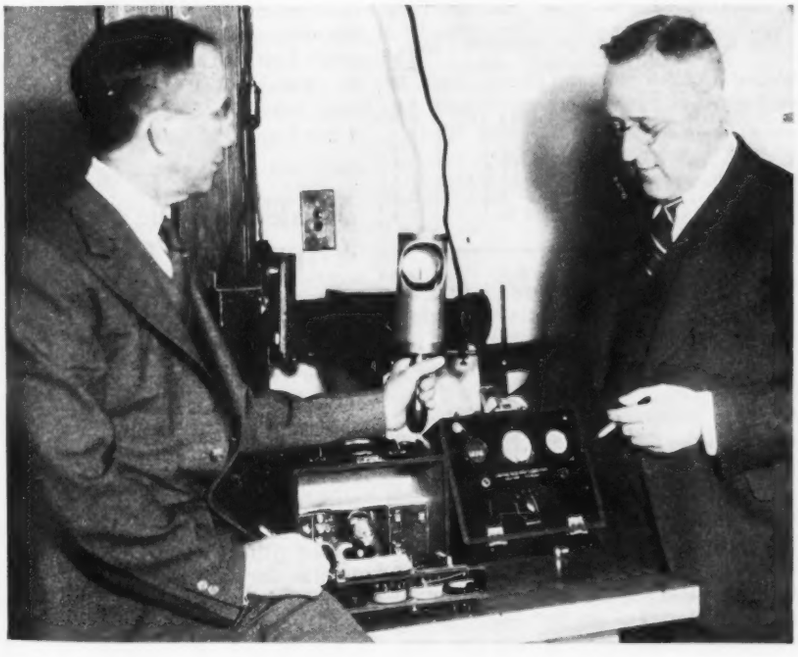
New Iowa taxation

The Iowa Senate has passed a three-point administration tax bill relating to personal income tax, corporation tax and retail sales tax. In the corporation bracket net income would be taxed a flat 2 per cent. Utility rates provide that upon gross receipts from the sale of electricity, gas, water and telephone and telegraph service a tax of 2½ per cent will be levied.

To give towns the opportunity of tieing in with the T.V.A. a bill giving municipalities of "more than 1,000 population and less than 500 authority to provide power lines has been introduced in the Mississippi House.

In addition to the earlier measures introduced in the Kentucky Legislature (ELECTRICAL WORLD, February 10, page 236) another bill requiring utility companies to pay 6 per cent interest on deposits from consumers has been introduced in the state Legislature.

ULTRA-VIOLET RADIATION NOW FULLY MENSURABLE



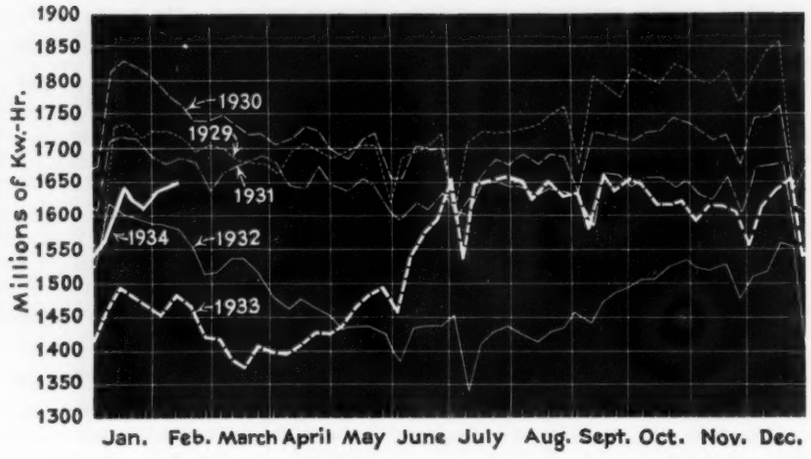
Responding to a long-expressed need in artificial sunlight applications and studies for a meter to measure the biological effectiveness of ultra-violet radiation, as well as to observe directly natural sunlight values, an integrating instrument has been developed. This meter integrates the total ultra-violet radiation emitted by a source for the length of time the light source actuates an electric cell. The cell current charges a condenser and when a unit of ultra-violet light has been emitted the condenser "spills over" and turns the counting relay, so ultra-violet rays are measured as definite units. Another meter similar in purpose has been developed to measure instantaneous radiation strength. Much of the guesswork with which physicians have prescribed ultra-violet treatments may now be eliminated. A. H. Taylor of the General Electric Lighting Research Laboratory holds the electric cell, Dr. M. Luckiesh, also of Nela Park, is the observer.

Sodium Units May Light New York Tunnel

As the result of the compared reactions of various individuals to tungsten and sodium-vapor illumination determination will be made as to the best type of lighting for the new New York midtown tunnel. Sodium-vapor lighting, used in the new Antwerp, Belgium, tunnel and on Dutch and American highways will be studied in comparison with tungsten lighting as two groups of twelve Civil Works Administration employees each works four hours a day under the respective lights.

Their acuity of vision and reaction to sunlight will be studied for three months by doctors of the United States Public Health Service and the Port Authority. Four-hour shifts are adopted to simulate conditions under which tunnel policemen work. If favorable results are shown the Port Authority will be enabled to use sodium-vapor lights, which give high visibility, for no more than one-third the cost for equal illumination.

Output Continues to Rise



With an output of 1,651,535,000 kw.-hr. during the week ended February 10, according to the Edison Electric Institute, central-station energy production again advanced, this time to the largest weekly total thus far recorded in 1934. It exceeded that of the corresponding period a year ago by 11.4 per cent and two years ago by 4.6 per cent. The gain over the preceding year is being maintained at a higher rate than during the past few months and the two-year increase is even larger than it was a week ago.

The maximum for the first full week in February was recorded in 1930. The present output missed this by only 7.3 per cent and the trend appears to be upward, whereas normally at this season it is downward. Year-to-year gains are especially strong in the manufacturing regions.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
Feb. 10...1,652	Feb. 11...1,483	Feb. 13...1,579
Feb. 3...1,636	Feb. 4...1,455	Feb. 6...1,589
Jan. 27...1,611	Jan. 28...1,470	Jan. 30...1,589
Jan. 20...1,625	Jan. 21...1,484	Jan. 23...1,598
Jan. 13...1,646	Jan. 14...1,495	Jan. 16...1,602

Per Cent Change from Previous Year

Region	Week ended Feb. 10	Feb. 3	Jan. 27
New England.....	+12.9	+11.8	+ 8.6
Middle Atlantic....	+11.6	+12.3	+ 9.9
Central Industrial..	+14.5	+16.6	+13.1
West Central.....	+ 4.6	+ 6.2	+ 5.2
Southern States....	+10.0	+10.8	+ 7.9
Rocky Mountain...	+ 8.9	+17.6	+17.5
Pacific Coast.....	+ 8.5	+ 8.6	+ 2.8
United States.....	+11.4	+12.5	+ 9.6

Municipal Tax Exemption Fought by Seattle Utilities

Maintaining that the Seattle municipal plant, being exempt from the license tax recently imposed by an ordinance of that city, was in a position to undersell the privately owned companies in ruinous and unfair competition, counsel for the Puget Sound Power & Light Company and the Seattle Gas Company have attacked the validity of the statute before Justices Brandeis and Roberts of the U. S. Supreme Court, who are hearing the case. The high tribunal had granted the companies a review from a lower court decision upholding the city ordinance (ELECTRICAL WORLD, October 21, page 519).

If either of the companies should attempt to recoup by an increase in rates the license tax levied on it by the city, permission would probably be denied, counsel for the campanies asserted, and there is not much doubt, they said, as to what the ultimate effect would be in the loss of customers should they attempt to charge higher rates than the municipal plant. They insisted that when the municipality entered into competition with private business, unless prohibited from levying such a tax, the city was in a position to raise the license tax to a rate which would deprive the companies of all profit and amount to the confiscation of their property. City Light Auditor Arthur O. Olsen declared that City Light has paid the city's occupational tax since it was imposed, and has already paid the city treasurer $160,000 based on 3 per cent gross monthly earnings. He said it was his understanding that the stand of the private companies is that the payments by City Light are not made in good faith.

Cuban Workers Return

Striking employees of the Compania Cubana de Electricidad have returned to their jobs in accordance with the recent decree outlawing strikes until after arbitration. Last week President Mendieta signed the decree outlawing strikes affecting light, water, telephone, telegraph, medical, pharmaceutical, fire-fighting and transportation services. The decree provided machinery for settling labor troubles. A maximum penalty of two years' imprisonment is provided for violations. Several districts just beyond the limits of the city of Havana have as yet no electricity (ELECTRICAL WORLD, February 10, page 235).

Record Energy Output in Canada in December

Following a month of greater production than ever before in the history of the industry, output of central stations in Canada increased by another 5,500,000 kw.-hr. in December, to 1,707,885,000 kw.-hr., according to the Dominion Bureau of Statistics. This is 19 per cent more than in December, 1932. As usual, more than 98 per cent came from water power. The total for the year 1933 was 17,552,999,000 kw.-hr., compared with 15,862,986,000 in 1932, a gain of 10.7 per cent.

Of hydro-electric production in December the Province of Quebec contributed 862,635,000 kw.-hr., or somewhat more than half and 7.7 per cent more than in the same month of 1932. Ontario produced 515,568,000 kw.-hr., with the extraordinary increase of 58 per cent; British Columbia 120,838,000 kw.-hr., gaining 17 per cent, and the Maritime Provinces 50,520,000 kw.-hr., losing 4 per cent.

Federal Trade Probe Approaches Completion

Investigation into ownership and financial operation of utilities by the Federal Trade Commission during the past five years with the objective of recommending whatever legislative changes may be necessary is swinging into its final stages, with examiners scanning the books and records of the half dozen remaining companies. The commission hopes to conclude its mass of evidence before June 30, the date set by the Senate for terminating the investigation.

Final stages of the investigation are being aimed at securing data on gas companies, which were sidetracked somewhat to make room for the electric companies. Since 1928 the commission has examined the affairs of eleven large holding companies with more than 100 subsidiaries, including the Morgan, Insull and Doherty interests. The commission estimated that the investigation will represent companies supplying 45 per cent of the electrical energy output in the country and approximately 80 per cent of electricity sold by privately owned companies in interstate commerce.

As to Rates—

• Gary (Ind.) Heat, Light & Water Company has submitted to the Indiana Public Service Commission a proposal to reduce its electricity rates in the higher brackets 12 per cent. The proposal marked the latest development in the two-year controversy between the utility and the city. Recently the commission threatened the utility with a formal audit and appraisal hearing if it did not grant an 18 per cent reduction.

• Carolina Light & Power Company's rate reduction of 12½ per cent to mills in the state has been approved by the South Carolina Railroad Commission.

• Missouri Utilities Company has filed with the state Public Service Commission a new schedule of electric rates for Cape Girardeau and 23 other southeastern Missouri communities which will save residential customers a total of approximately $26,000 annually.

• Pacific Gas & Electric Company's new domestic schedule of rates applying to range and water heating installations has been ratified by the California Railroad Commission. Under the new schedule for single-family residences, including separately metered flats and apartments where the consumer has installed a standard electric range and electric water heater, all energy in excess of 170 kw.-hr. will be billed at 1 cent per kilowatt-hour.

Michigan case headed for court

• Detroit Edison Company and the Michigan Manufacturers Association's bills of complaint against the Public Utilities Commission's order for a reduction of $1,500,000 in rates will go to trial in the Ingham Circuit Court before Judge Carr, the Supreme Court on January 31 having denied application of the utilities commission that the complaints be dismissed (ELECTRICAL WORLD, January 27, page 167). The Edison complaint pleaded for a restraining order, which was granted by Judge Carr. The company had announced that it was putting into effect a $1,000,000 rate reduction. The manufacturers' association set forth that the reduction should total $5,000,000 instead of $1,500,000.

• Savannah Electric & Power Company has agreed to a new residential rate cut estimated to save consumers $30,000 a year. The cut is the second for the company this year, one revision having gone into effect January 1 (ELECTRICAL WORLD, January 6, page 62).

• Queensboro Gas & Electric Company has obtained a temporary injunction from Supreme Court Justice John T. Loughran preventing the New York Public Service Commission from enforcing upon the company a rate reduction of 15 per cent until after the Appellate Division investigates the cut in electric and gas costs in Queens County. The court held that great and irreparable damage to the company would result if the rate reduction became effective and months later the courts held it was illegal.

• United Power & Light has reduced its electric rates for residential and commercial purposes in the 122 cities and towns it serves in central Kansas. Reductions range from 7 to 27 per cent.

• Georgia Power Company has been ordered by the Public Service Commission to reduce its rates for commercial customers approximately $268,000 annually. The reductions will be distributed among 28,000 commercial customers, 20,000 of whom will receive a flat reduction of 70 cents per month and the remaining 8,000 a flat reduction of $1.70 per month. The new schedule was announced after a long study by the commission, one issued several months ago having been revoked before it went into effect. The new rates go into effect with meter readings on and after March 1.

• Indiana Public Service Commission is receiving protests from patrons of municipal utilities over its general order to all utilities regulating collection charges. The order decreed that all bills should be mailed net with a fixed rate for added charges for collections after the expiration of ten days. The increase was based on the amount of the bills.

Municipal Items

GREENSBURG, IND.—Referendum election has been ordered by City Council for February 27 on question of purchase or construction of municipal light, gas and water plants.

COLUMBIA, MO.—City Council has voted to withhold payment of the state sales and service tax of one-half of 1 per cent on the receipts of municipally owned light and water plants until the courts have passed on the question. Recently Attorney-General Roy McKittrick ruled that the new tax would apply to municipally owned utilities. Mayor Pollard in urging the withholding of the tax stated that he is of the opinion the state Legislature did not intend to apply the tax to municipally owned plants.

RUTLAND, VT.—Voters at the March election will be asked to ratify a provision in the existing city charter which gives the city the legal authority to own and operate electric and gas plants.

RICHMOND, VA.—Plans to launch this city in the power business with the aid of a $5,000,000 bond issue and a possible grant from the Public Works Administration were introduced at a meeting of the Common Council simultaneously with steps to have the city investigate the advisability of building its own power plant for the sale of electricity. A resolution authorizing a $5,000,000 issue of 4 per cent city of Richmond bonds, the proceeds to be used for the "construction, reconstruction, extension and improvement of electric production and distribution facilities in the city," was introduced under suspension of the rules by Councilman Carleton E. Jewett.

CULPEPER, VA.—Appeal by the Virginia Public Service Company from a recent Circuit Court decision denying its application for an injunction to restrain the town from issuing bonds for the erection of a municipal plant (ELECTRICAL WORLD, January 6, page 61) was refused last week by the State Supreme Court.

CUSHING, OKLA.—Special election is to be held February 20 for the purpose of submitting to taxpaying voters a proposed $280,000 bond issue to provide funds for construction of an electric power plant and distribution and transmission lines. Three years ago this city voted bonds in the sum of $300,000 for the same purpose. The original issue was canceled and the new proposed issue is being submitted to determine whether the citizens now wish to avail themselves of Public Works Administration funds to secure a municipal electric plant.

MUNICE, IND.—A petition bearing names of 2,600 voters, about three times the number required by law, has been presented to City Council demanding that an election be called to determine whether the city shall buy the electric plant of the Indiana General Service Company and the gas plant of the Central Gas Company. The action is taken under provisions of the last state law which says such an election becomes mandatory when a petition is presented containing names of 5 per cent of the total number of voters who cast ballots for office of city clerk in the last preceding municipal election. The only question before Council is whether to hold the election before or at the time of the primaries on May 8.

CORNING, IOWA.—City Council will open bids on March 12 for the construction of a municipal light and power plant together with three Diesel engine units of 225 hp., furnishing 150 kw.-hr. each, all auxiliary equipment and a distribution system, estimates being $160,000. Council will also take energy bids for a year, approximate requirements being 750,000 kw.-hr. per year.

FINANCIAL · · · BUSINESS

N.E.M.A. Membership Rises 240 Per Cent

From a membership of 262 in June, 1933, National Electrical Manufacturers Association has grown to 635 as of January 22, while sections and groups have expanded from 50 in June to 157 on January 1. At present sections and groups are composed of 61 sections, 88 groups and eight sub-groups. Approximately 35 supplemental codes for subdivisions are in preparation. Coincident with this expansion, to handle the additional work of expanding activities the N.E.M.A. staff has grown from 25 in June, 1933, to 87 in January, 1934.

General Electric Wins New Suit Over Lamps

Judgments totaling $167,775.99 against the Desmond Incandescent Lamp Company for infringements on patents in favor of the General Electric Company entered this week in the United States District Court, New Jersey district, will be appealed by the Rex Manufacturing Company, successor to the Desmond organization. Under the judgment the company is ordered to pay $56,946.89. The judgments against the members of the firm are as follows: William J. Desmond, $75,398.50, and Martin F. Desmond, his brother, $32,100. Martin F. and William J., with Mrs. G. M. Desmond, wife of the latter, are also to pay $3,331.60 for costs of the action, which was started in 1925.

The suit charged that the defendants infringed upon the Just and Hanaman and Langmuir patents. In its suit the General Electric Company alleged the defendants infringed upon six patents. The courts held they had infringed upon two patents on the construction of gas-filled miniature light bulbs. The Desmond Incandescent Lamp Company ceased business in Jersey City in January, 1933, and moved to Harrison, where the business is being carried on under the name of Rex Manufacturing Company. Last week General Electric lost a lamp patent suit (ELECTRICAL WORLD, February 10, page 240).

STILL GAINING

Into current business facts comes a definite upsurge both as to prices and trade volumes.

Energy production stands 11.4 per cent over 1933 and 4.3 per cent over 1932; the increase is unseasonal; industrial centers show largest gains. Carloadings up 0.5 per cent over previous week and 16.1 per cent over last year, to new high ground. Automobile output highest since 1930—65,143 units, against 56,693 the week previous and 27,063 a year ago. Cotton forwardings and lumber orders continue to be encouraging. Steel activity rises to 39 per cent. A rapid picking up of pace.

Prices are touching new highs, commodity indexes match December, 1930, peak. Security markets, despite good news, show definite unsettlement under strict-trading-regulation threat of federal government.

Congress is being forced to decide just how long P.W.A. is to be continued. It appears that the vast expenditures promised may turn out to be less real than threatened; less compelling and more indecisive. And no harm in that.

New Opposition to N.E.M.A. Code

CONFLICT over the definition of the industry and vigorous objections by organized labor to the newly proposed wage and hour provision featured the public reconvened hearing late last week on a long list of amendments proposed for the approved code of fair competition for the electrical manufacturing industry. Deputy Administrator H. O. King conducted the hearing, and in questioning F. E. Neagle, counsel for N.E.M.A., as to whether the electrical contractors and erectors of electrical apparatus were opposed to coming under the code received the reply that the amended definition of the industry did not cover the installation or servicing of "supplies" and that electrical apparatus and appliances never had been part of the electrical contracting business, but installed and maintained by the manufacturer.

Labor growls again

Labor leaders and representatives of the American Federation of Labor vigorously attacked the labor amendments as representing a distinct backward step and could not see any justification for either geographical wage differential or differential in rates of pay between men and women. Hourly or weekly minimum rates proposed by the different leaders varied over a considerable range. Leaders deplored the objection to shorter hours and absorption of unemployed workers when some men were being worked as much as 72 hours to enable companies to meet their production demands at peak times.

Open price plan repudiated

In order to protect its business against "unscrupulous cut-throat competition which has developed and is being practiced in this industry," the Bond Electric Corporation, large manufacturer of flashlight cases and dry batteries, served notice last week on the trade, through the National Electrical Manufacturers Association, of which it is a member, that it had abandoned the open price filing plan for the dry battery and flashlight section under the code approved by the President on August 4, 1933, and reserved the right to make any price changes at any time and without filing the amended price lists under the code, "down to the actual cost of production of our merchandise."

C. Bertram Plante, president and chairman of the board, in connection with this announcement, said: "Theoretically, the open price filing system appears helpful, but in actual practice it has worked out to the detriment of the legitimate manufacturer by throwing his minimum prices open to every one, thus giving his most vital information to every 'gyp' in this industry."

The recently organized non-radio electronic tube section of the specialties product classification, which unanimously recommended the appointment of H. A. Jones of the General Electric Company, Schenectady, to the supervisory agency of that section, has had its request approved by the N.E.M.A. code authority.

Utility Issue Planned; Second Under New Law

Registration of the second and largest utility public bond offering since the new federal securities law became effective has been made by the American Water Works & Electric Company. This proposed issue of $15,000,000 ten-year convertible trust 5 per cent bonds, to be dated March 1, 1934, would be applied toward retirement of $12,569,000 of 5 per cent collateral trust bonds due April 1 this year. The previous registration was of a $3,000,000 issue by the Narragansett Electric Company (ELECTRICAL WORLD, July 1, 1933, page 3). The new bonds will be offered above par and will be convertible into common stock at the principal amount at a sliding scale from $20 a share on March 1, 1936, to $75 on March 1, 1942.

To comply with the requirements of the securities act of 1933, a prospectus was filed with the registration to the Federal Power Commission which thoroughly describes the new issue with its provisions and collateral, history of the

business and its growth, the capital structure in complete detail, accounting methods, detailed fiscal information, officers' salaries, large stockholders and shares held and amortization and depreciation policies, and contains an unusually detailed auditor's certificate, explanatory notes of figures and statements, a statement of "guiding principles used by the company in consolidating accounts," a list of pending rate and other proceedings, a statement of federal income tax liabilities of the company and its subsidiaries, names of experts employed, charter provisions relating to capital stock, general charter provisions, an analysis of outstanding options, a discussion of the issuance of additional bonds and details of the trust agreement covering the new bonds as they relate to substitutions of collateral security.

Utility Pay Cuts Shown in Federal Trade Report

In a report submitted this week in answer to a resolution passed by the Senate last May the Federal Power Commission reveals a decline in large salaries paid to executives and other officers of public utility corporations. Instances of officers serving two to four organizations were cited while in other instances no salary was reported for leading executives, even though the corporation was important.

A. F. Hockenbeamer, president of the Pacific Gas & Electric Company, was reported to have received $67,500 in 1933, slightly more than half of his compensation of $134,800 in 1928. He received $130,520 in 1929, $103,850 in 1930, $75,000 in 1931 and $72,777 in 1932. Harvey C. Couch, a director of the Reconstruction Finance Corporation, was shown as receiving $33,893 from the Arkansas Light & Power Company in 1933, $19,000 from the Louisiana Power & Light Company and $17,100 from the Mississippi Power & Light Company, or a total of $69,993 from these three sources.

1933 a year of cuts

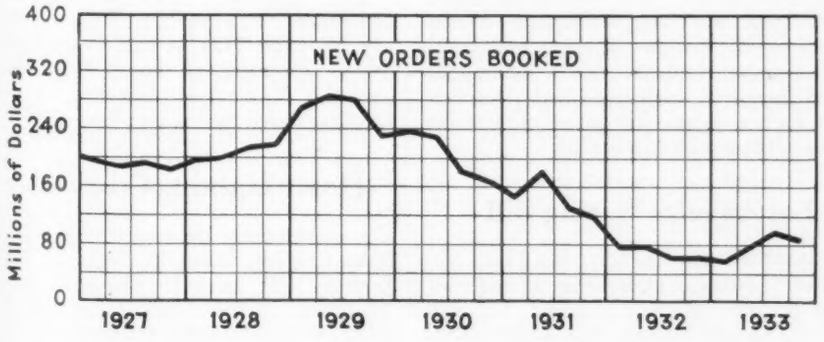
James Simpson received $40,000 as president of the Commonwealth Edison Company and $25,000 as chairman of the board of the Public Service Company of Northern Illinois. No salaries were listed from the New England Power Company or the New York State Electric & Gas Company. Paul Schoellkopf, chairman of the board of the New York Power & Light Corporation, was listed as receiving no salary either from that source or from the Niagara Falls Power Company.

The report showed that Franklin T. Griffith received $19,800 from the Portland General Electric Company in 1933, but had received $40,000 in 1928. The salary of W. C. Baylies, president of the Edison Electric Illuminating Company of Boston, was cut from $72,000 in 1928 to $32,000 in 1933. Among other utility executives who received substantial cuts were G. G. Allen, president of the Duke Power Company, and S. B. Way, president of the Milwaukee Electric Railway & Light Company.

Security Markets Show Decline

Obviously disturbed by the proposed and imminent federal regulation of exchanges, all security markets yielded ground this week. "Electrical World" utility stock average 27.0; last week 29.0

ELECTRICAL MANUFACTURING GAINS TAPER OFF



Breaking the rate of increase maintained for the two previous quarters, new orders booked in the fourth quarter of 1933, as reported to the Bureau of the Census by 78 manufacturers of electrical goods, were $88,765,448, as compared with $98,768,057 for the third quarter of 1933 and $62,911,874 for the fourth quarter of 1932. The 1933 total was $325,287,322, as compared with $282,662,547 in 1932 and with the record for 1929 of $1,065,510,043. The total includes motors, storage batteries, domestic appliances and industrial equipment, and while not a complete statement of the industry is sufficiently representative to show the trend in electrical manufacturing.

East Coast Plan Approved

Sale of all assets of the East Coast Utilities Company has been sanctioned by the Chancery Court of Wilmington, Del. This move has been taken to further the plan of reorganization of the company, a former subsidiary of Empire Public Service Corporation. The sale will take place at the company's office at Richmond on February 26, with no upset price fixed by the court. Sale of the assets of another Empire subsidiary took place recently in Wilmington with bids of $20,203 aggregate for five parcels offered. A claim of $2,246,389 against bankrupt Louisiana Ice & Utilities, Inc., was bid for $20,000 and the other parcels were bid at $203.

Ingersoll-Rand Acquires G. E. Turbo-Blower Line

Acquisition of the turbo-blower business of the General Electric Company and early consolidation with it of its own turbo-blower department is announced by Ingersoll-Rand. This organization has for a long time made blowers of medium and large capacities, for pressures up to 100 lb., and will now produce both single- and multi-stage units for a variety of services in low and medium pressures in which General Electric specialized. Ingersoll-Rand also secured an exclusive license under the various General Electric turbo-blower patents. Manufacturing equipment previously employed by General Electric is being moved to Phillipsburg, N. J.

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Norge Advertising Budget

At a convention of dealers of the Norge Company of Detroit held recently in St. Louis announcement was made that the company will spend approximately $2,000,000 in advertising its electric refrigerators during 1934. The 1934 advertising budget more than doubles that for 1933.

Eureka Profit Up in 1933

Net profit of the Eureka Vacuum Cleaner Company for the year 1933 after taxes, depreciation, reserve for possible loss on deposits in closed banks, and other charges, amounted to $99,036, equal to 40 cents a share on 244,918 five-dollar par capital shares, against $48,110, or 19 cents a share, on 247,953 no-par shares in 1932.

57,500-Kw. Rectifier Order

Said to be the largest order for rectifier equipment ever placed in the United Kingdom, the Southern Railway of England has contracted for 23 Peebles-Brown Boveri steel-cylinder type mercury-arc rectifiers with main and auxiliary transformers, recooler equipment, control panels and accessories on the Eastbourne-Hastings and Sevenoaks electrification extensions of the line. Each rectifier will have a normal output of 2,500 kw. at 660 volts with overloads up to 8,000 kw. and the total capacity ordered is 57,500 kw. Main transformers will be self-cooled and operating on 33,000 volts, three phase, 50 cycles on the primary and the secondary windings will be double six-phase connected, there being twelve anodes per rectifier.

New York Metal Prices

	Feb. 6, 1934 Cents per Pound	Feb. 13, 1934 Cents per Pound
Copper, electrolytic	8.00	8.00
Lead, Am. S. & R. price	4.00	4.00
Antimony	7.15	7.15
Nickel ingot	35.00	35.00
Zinc, spot	4.75	4.75
Tin, Straits	50.75	51.75
Aluminum, 99 per cent.	23.30	23.30

Arizona Contract Approved

Final approval was given in Washington recently to a $1,350,000 R.F.C. contract calling for rehabilitation of the Agua Fria River project (Maricopa County Municipal Water Conservation District No. 1) west of Phoenix, Ariz. The project involves cultivation of an additional 19,000 acres of land, repair of Lake Pleasant Dam across the river, 30 miles northwest of Phoenix, correction of structural defects in the dam, raising the dam spillways, construction of a new flume across the river, building a new distribution system and lining part of the canal.

Boulder Dam Breakers

Contract for generator oil circuit breakers at the Boulder Dam power station, totaling $350,000, has been awarded to the Allis-Chalmers Manufacturing Company of Milwaukee. The order includes ten of the largest circuit breakers ever made, according to Max W. Babb, president.

Buying Expansion Urged

Expansion in industrial buying policies so that manufacturers will be covered for at least three months ahead on requirements was urged by the business survey committee of the National Association of Purchasing Agents in its recent report on business conditions, made public last week. The committee, which has been advising purchasing executives for the last two years to hold commitments to minimum needs, announced that improved conditions and prospects for higher commodity prices now make larger inventories desirable.

Los Angeles Wiring Bill

Probability that the Los Angeles electrical ordinance governing wiring will not become effective April 7, but will be completely revised, has developed as the result of meetings which have been held continuously during the last four months for the purpose of discussing its provisions. The ordinance as signed by the City Council contains 160,000 words and amendments proposed at the meetings between contractors, utility company representatives and manufacturers with the City Electrical Department exceed the ordinance in volume.

Major New Construction This Week

Consolidated Gas, Electric Light & Power Company, Baltimore, Md., plans power substation and switching station to serve electrified lines of Pennsylvania Railroad. Cost about $1,000,000, including feeders.

Shelby, Iowa, asks bids until March 8 for construction of city-owned electric power distribution system, including poles, crossarms, wire and cable, switches, meters, transformers, etc.

Premier-Pabst Sales Corporation, Chicago, Ill., plans $150,000 multi-story brewery unit at Peoria, Ill.

Heavy-duty motors, controls, transformers, regulators, conveyors, etc., will be installed by duPont Rayon Company at Ampthill, Richmond, Va. A $5,000,000 project.

Farmington, Mo., plans new city-owned electric light and power plant at cost of $120,000, including Diesel engine-generators, units and accessories.

Motors, controls, electric hoists, regulators, conveyors and other equipment will be installed in $800,000 addition to Chicago, Ill., plant of Campbell Soup Company.

Crewe, Va., plans city-owned electric light and power plant. Federal fund of $126,000 being arranged.

Transformers, accessories, heavy-duty motors, electric hoists, regulators, conveyors, etc., will be installed in lime and chemical works of Louisiana Products Corporation near Winnfield, La. Cost about $1,000,000.

Kelley Breweries & Distilleries, Inc., Minneapolis, Minn., plans $300,000 expansion.

Red Bluff Water Power Control District, Pecos, Tex., has fund of $2,600,000 through federal aid for new hydro-electric generating plant, power substations, transmission and distribution lines, with series of electric-operated pumping stations for irrigation system.

The standard electrical appliance ordinance (ELECTRICAL WORLD, January 20, page 132) is still in the hands of a committee of the City Council awaiting favorable reports. It has been approved by the city attorney.

Home Lighting Conference

To instruct in the new approach to home-lighting sales a lighting conference will be held February 28 to March 3 at the General Electric Institute, Nela Park, Cleveland. The conference, the first of its type to be offered by the institute since its dedication last December, will feature such important phases of the subject as the new science of seeing, home-lighting application, control and design, and effective sales technique. In addition to lectures and demonstrations by the staff of Nela Park, outside experts will contribute to the sessions.

MEN OF THE INDUSTRY

N. E. Drexler Assumes New Executive Duties

Norman E. Drexler, who for the past six years has been eastern division manager of the Virginia Public Service Company, has been elected a vice-president of the company. He is also president of the Citizens Rapid Transit Corporation and the Hampton Towing Company, subsidiaries of the Virginia Public Service Company, and vice-president of the Hampton & Langley Field Railway Company.

After graduation from the Rensselaer Polytechnic Institute in 1912, Mr. Drexler entered the utility field as an assistant in the engineering department of the Newport News & Old Point Railway & Electric Company at Hampton, Va. In 1916 he was made chief engineer of the Newport News & Hampton Railway, Gas & Electric Company, successor to the Newport News & Old Point company, and nine years later he was made manager of the gas and electric departments.

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WILLIAM W. BODINE, vice-president of the United Gas Improvement Company, has been elected to the newly created office of executive vice-president.

PAUL DOTY, president of the American Society of Mechanical Engineers, has been elected a vice-president of the American Engineering Council. Mr. Doty is chairman of the Minnesota State Board of Registration for Architects, Engineers and Land Surveyors, St. Paul, Minn.

SEVERE GODIN, JR., who has been identified with the Montreal Light, Heat & Power Consolidated since 1905, has been appointed a vice-president of that utility. Mr. Godin has of late years been engaged in financial work for the company and three years ago was appointed to membership on the board of directors. He is an officer or director of a number of industrial and other public utilities in Canada.

JOHN B. WHITEHEAD, president of the American Institute of Electrical Engineers and professor of electrical engineering and dean of the faculty of engineering of Johns Hopkins University, has been made an honorary member of the Société Française des Electriciens. On the occasion of the celebration of its fiftieth anniversary last month the société awarded this distinction to a prominent electrical engineer in each of the larger European countries, in Japan and in the United States. Dr. Whitehead received the only award in this country.

JOHN HENRY NANCE, of Cross Hill, S. C., has resigned as chairman of the South Carolina Railroad Commission. He was elected a member of the commission by the legislature six years ago.

J. D. GAREY, chief engineer of the New Brunswick Power Company, St. John, N. B., was elected president of the New Brunswick Association of Professional Engineers at the annual convention held recently at St. John. Mr. Garey has been an electrical engineer with the New Brunswick Power Company for the past 22 years and chief engineer of the power plant at St. John for the past eight years.

C. E. STEPHENS, vice-president of the Westinghouse Electric & Manufacturing Company, New York, has been elected treasurer of the American Engineering Council. Mr. Stephens is a representative of the American Institute of Electrical Engineers on the administrative board of the American Engineering Council Assembly.

C. O. BICKELHAUPT, vice-president of the American Telephone & Telegraph Company, New York, has been elected a vice-president of the American Engineering Council. Mr. Bickelhaupt is a fellow and a past vice-president of the American Institute of Electrical Engineers and at the present time is a representative of that society on the administrative board of the American Engineering Council Assembly.

W. E. CALDWELL, efficiency engineer, operating department of the United Electric Light & Power Company, N. Y., has been awarded the Melville medal for 1933 of the American Society of Mechanical Engineers for his paper on "Characteristics of Large Hell Gate Direct Fired Boiler Units," described as a thesis of exceptional merit. Mr. Caldwell has been connected with the United organization since 1913.

ALFRED PAULUS, illuminating engineer of the Westinghouse Lamp Company, Bloomfield, N. J., since 1927, has been transferred to the Pittsburgh office as district engineer of the east central division. Graduated from Carnegie Institute of Technology in 1922, Mr. Paulus immediately joined the lamp company and for a number of years served as an engineer in the manufacturing department. In 1927 he was transferred to the commercial engineering department when Westinghouse was expanding its lighting development work.

FRANK J. REARDON, assistant corporation counsel of Jersey City, has been confirmed by the Senate as a member of the New Jersey Board of Public Utility Commissioners.

OBITUARY

JOSEPH A. MCGOWAN, superintendent of the Fitzgerald Manufacturing Company, electrical supply manufacturer of Winsted, Conn., died suddenly January 23, of a heart attack, in his fifty-first year.

H. W. NELSON, an Edison pioneer, died suddenly, January 24, in Fort Myers, Fla., at the age of 66. Mr. Nelson, who was born in England, came to this country when 18. While an associate of Thomas A. Edison he had several electrical inventions to his credit.

E. O. WATTIS, president of Six Companies, Inc., builder of Boulder Dam, died at his home in Ogden, Utah, February 3, of heart disease. One of the leading contractors in the West, Mr. Wattis and his brother, the late William H. Wattis, officials of the Utah Construction Company, were active in the organization of the Six Companies, which bid and received the federal government contract for construction of Boulder Dam. He was 78 years of age.

EARL H. RICHARDSON, inventor of the Hotpoint electric iron and manager of the Ontario, Cal., plant of the General Electric Company, died suddenly January 31, at his Ontario home. Mr. Richardson developed the Hotpoint iron while employed in a power house of the Stonecastle Power Company at Ontario. He also was identified with the first electric railway in Ontario, having charge of its operation the first year after its completion. He was 62 years of age.

WILLIAM A. O'DWYER, electrical inspector, Detroit Edison Company, died suddenly January 23. Mr. O'Dwyer's work with the Detroit Edison Company involved the investigation of fires that were reported as being of electrical origin and of accidents reported as having been caused by electric shock. His work in these fields is widely known through his affiliation with the International Association of Electrical Inspectors, in which organization he had been active for many years.

NEW EQUIPMENT

Impulse Breaker Saves Oil, Speed Cuts Arcing Time

High-voltage, large capacity oil circuit breakers containing many unusual and new features have been announced by the General Electric Company. Radical in design, the units are cross-shaped (ELECTRICAL WORLD, February 10, page 218), in contrast with the tank-like construction of conventional equipment. Higher rupturing speeds with short arcing intervals and the use of very little oil are nominated advantages. Only 96 gal. of oil per pole is required by a breaker with an interrupting rating of 1,500,000 kva. at 138 kv., compared with approximately 1,700 gal. per pole for a conventional type of equal rating.

Horizontal containers, not much larger than conventional bushings, inclose the interrupting mechanisms. These containers are mounted on vertical central supports which, in addition to serving in an insulating capacity, also house current transformers when such equipment is required. The operating mechanism is located in the base of each single-pole unit and an insulated operating rod passes up through the central support to the container. The interrupting elements consist of several sets of contacts in a line and the inside of each container is so arranged that oil, driven by a piston, is positively directed across the arc path of each of the several arc breaks per pole during circuit interruption.

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FLOOR-EDGING MACHINES are announced by the American Floor Surfacing Machine Company, Toledo, Ohio, which are fitted with a special roller guard that enables the sanding of floor edges right up to the baseboard or shoestrip without danger of marring finished woodwork. The "American Spinner" weighs but 20 lb.; dust and deposits are collected in a bag.

ELECTRICAL INSULATION MATERIAL of a new type, known as "Harvel Oil Stop," is manufactured by the Irvington Varnish & Insulator Company, Irvington, N. J. It is a viscous, non-drying oil with good electrical properties which, applied in liquid form, "sets" in location, even in the absence of air, to form a firm rubber-like structure which is not affected by oil or strong solutions of either acid or alkali and is waterproof and weatherproof. Heat will not soften it, but hastens its reaction toward solidification. "Oil Stop" does not contain any solvents and adheres to rubber, varnished cambric, oil-impregnated paper and copper, so it is suitable for use in all types of cable splices and cable terminals and for splicing oil-impregnated, paper-insulated cable to rubber-insulated cable in particular.

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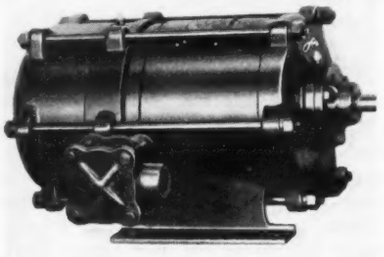
Explosion-Proof Motors of Capacitor Type

Single-phase explosion-proof, self-contained capacitor motors have just been announced by the Louis Allis Company of Milwaukee. Available at present in non-ventilated type from ½ to 1



hp., and totally inclosed, fan-cooled type from 1½ to 3 hp., these motors are especially adaptable for oil bulk station use as well as for all Class I, Group D hazardous locations. They can be connected externally for 110 or 220 volts. A special feature is the capacitor, which is self-contained within the motor and controlled by a simple positive-acting switch which cuts it out at a definite pre-determined speed. This type has the advantages and conveniences of a polyphase motor, for there are no brushes to inspect or replace, nor any capacitors to be mounted outside the explosive zone.

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AN ELECTRIC ERASING MACHINE, light and compact in construction, has been announced by the Charles Bruning Company, Inc., New York and Chicago. Held in the fingers like a pencil, it gives finger control for erasing pen and pencil lines from drawings or tracings.

HEAVY-DUTY PLUG RECEPTACLES, marketed as "Hubbellock," are offered by Harvey Hubbell, Inc., Bridgeport, Conn. Their rating is 20 amp., 250 volts d.c., 440 volts a.c. They are suitable in industrial plants for use on portable electrict drills and grinders or anywhere that portable tools or appliances are used. Grounding of metal casings is positive; steel casings are ⅛ in. thick; polarization is identified so cap cannot be inserted wrong; adjustable cord-grips relieve all strain from wiring connections, and lock-fast connection is insured by a "twist-lock" feature that locks the connector body to the receptacle.

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Ultra-Violet Meter Measures "E-vitons"

Integrating and indicating ultra-violet meters have been introduced by the General Electric Company, Nela Park, Cleveland, to measure the total radiation for a given time of the sun or a sunlamp. They are particularly suited for calibrating sunlamps and for measuring their ultra-violet output in the treating of patients, but offer the possibility of measuring the sun's ultra-violet output for a given location and day. The integrating meter is incased in a 8x10x7-in. portable case and the photo-electric cell is connected to the meter by an extension cord. The indicating meter is similar in construction.

The ultra-violet meters measure radiation lying in the region between 2,800 and 3,200 Angstrom units, which is the vitamin D and erythema, or sunburn, producing band. The unit of measurement of biologically effective radiation is the "E-viton" (10 microwatts) per square centimeter, which is the erythemal unit developed by the G. E. engineers.

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SPRING CLIPS FOR MONTHLY BILLS on customers' premises have been introduced by the Patent Novelty Company, Fulton, Ill., in two forms. One is a spring steel clip with name disk to hold the bills and the other provides, in addition, protection from snow or rain. They eliminate delivery problems under recent postal rulings against mail box use for non-postal purposes.

COVER CONTROL INDUSTRIAL SWITCHES which are compact and positive in their "quick-acting" operation are announced by the Wadsworth Electric & Manufacturing Company, Inc., Covington, Ky. The units are available, fused or unfused, in 2, 3, 4 and 5 poles, 230 and 575 volts. Switches are equipped with a new switch mechanism that have self-aligning rectangular formed blades; each blade seats in an individual fiber carrier and switch-jaw sets are mounted in an individual insulated recess; contact is made and broken within this insulated recess; positive quick-make and quick-break mechanism and interlocking device are also features. Cabinets are small, with ample working space allowed, and concentric ring-cut knockouts are provided.